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OCTOBER, 1944

Contents

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MODERN Machine Shop

OCTOBER, 1944 VOL. 17, NO. 5

CINCINNATI, OHIO

We Present---

—as the feature article in this month's issue — "Marine Engines By Hendy, II." In this, the second half of the article, the assembling and machining operations on the crankshafts are described; also treated are the machining and balancing operations on the rotor for an 8,500 h.p. steam turbine.

—on page 138 — "Use of Negative Rake Tools in Production of Aircraft Parts," written by Mr. J. Q. Holmes, Master Mechanic, Eastern Aircraft Division, General Motors Corporation, Linden, New Jersey. In this article Mr. Holmes tells how, upon experimenting with negative rake tools for milling, turret lathe and precision boring work, his company was successful in getting the "most of the best for the least" in the production of "Wilder Wildcat" fighter planes for the United States Navy.

—on page 166 — an announcement of the 26th Annual National Metal Congress and War Conference Displays to be held at the Public Auditorium, Cleveland, Ohio, October 16 to 20. Following pages present the Programs of the Technical Societies including the American Society for Metals, A.I.M.E. Metals Divisions, Society for Experimental Stress Analysis, American Welding Society, American Industrial Radium and X-Ray Society, Inc.; and a list of the exhibitors participating in the War Conference Displays.

—on page 310 — the "New Shop Equipment" department, followed by cartoon and other features.

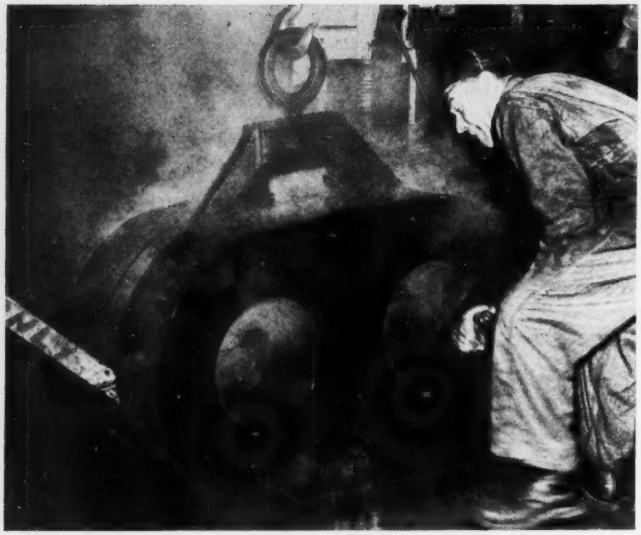


Fig. 12—Removing a Crankshaft Web from the Hot-Oil Tank. It is Transported to the Shrinking Stand, Where It is Assembled to the Crankpin while Hot.

Marine Engines By Hendy, II.

In this, the second half of the article, the assembling and machining operations on the crankshaft are described. Machining and balancing operations on the rotor for an 8,500-h.p. steam turbine are included.

By HOWARD CAMPBELL

THE Liberty Ship engine—a 2,500-h. p. triple-expansion reciprocating marine steam engine—is a giant two-story power plant weighing 137 tons. Its crankshaft alone weighs 20 tons and is an assembled job, the crankpins, thrust shafts, and webs being separate and individual pieces.

Six webs, each weighing 1800 pounds, are used in the assembling of one shaft. When ready to assemble the webs to the shaft, the webs are moved, in sets of two, into special heating tanks containing a special heat-resistant oil that has been heated to a temperature of 550 degrees F. The webs are immersed in the hot oil for a period of three hours which is sufficient to bring them to the required amount of expansion.

While the webs are being heated, the journal pins, crankpins and thrust shaft are placed in position on the shrinking stand, the webs being spaced at the correct angles to each other by the use of height blocks. The shrinking stand holds the journal pins and thrust shaft in the correct alignment within limits of 0.005 inch. The tolerance before finish turning is 0.010 inch, and the holding bases of the stand are keyed to the bedplate to assure this accuracy of alignment.

The crankpins are brought to the shrinking stand in a semi-finished condition, the journal pins and thrust shaft being semi-finished to a tolerance of 0.050 inch, to be finished in the lathe after the shaft has been assembled. One of the principal secrets of successful crankshaft web assembly, according to Hendy engineers, is to have the webs in balanced relationship even though they may not be absolutely parallel.

When the webs have been heated sufficiently to bring them to the specified amount of expansion, the crew moves into action like a perfectly-trained football team. A single web is hoisted from the heating tank, as shown in Fig. 12, and carried by the crane to the shrinking stand. As it is brought even with the end of the first journal two men, using bars, steer it onto the pin. At the same time a jack is placed under the web, as shown in Fig. 13, the jack being set at the approximate height to give the web the exact 120-degree angle required in relationhip to the other webs.

With the first web in position, a second web is brought by the crane and maneuvered into position in the same manner. The stands of the shrinking stand are moved longitudinally as required to permit the entrance of the web, and as soon as the web is in position on the crankpin, the next journal pin is moved into the opposite end of the web. Height blocks are placed under the crankpin to assure correct positioning, and the jack is removed.

The same procedure is followed with each of the two remaining sets

Fig. 13 — Assembling a Web to the Crankpin after It has Been Expanded by Heating in Hot Oil. A Jack is Set under the Web to Hold It at the Required 120 - Degree Angle to the Other Webs

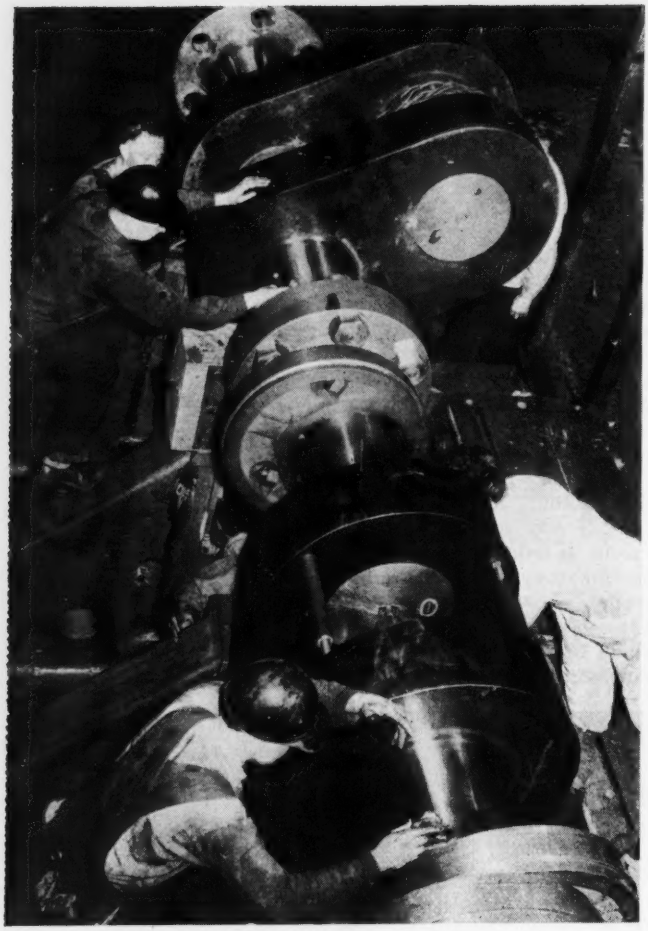


Fig. 14 — Assembling a Liberty Ship Engine Crankshaft on the Shrinking Stand. The Shrinking Stand Holds the Journal Pins and Thrust Shaft in Alignment within Limits of 0.005 Inch

of webs. The time required to assemble a set of webs averages seven minutes, which is remarkably fast considering that the parts are large and heavy, that the webs must be brought by crane from the heating tanks, and that the assembling job must be done within comparatively close tolerances. The webs cool sufficiently to begin shrinking within thirty minutes after they have been anchored in place, and the completely-assembled shaft is left to cool for a period of twelve hours.

When the shaft has cooled, holes are drilled and reamed for dowels which are pressed into the holes to prevent the webs from slipping under the tremendous pressures to which they will be subjected in service.

The hole-drilling operation is performed with a portable drilling machine which can be clamped to the tops of a set of webs, as shown in Fig. 15. Power is derived from a motor that is bolted to the base plate upon which the tool is mounted, the power being transmitted through a chain drive to the machine spindle. A gear motor is provided to feed the tool through the work, the power being transmitted through a light chain to the feed screw as shown in the illustration.

There are two inside and two outside dowels in each set of webs; thus the holes are drilled in sets of two. Following the drilling, the webs are

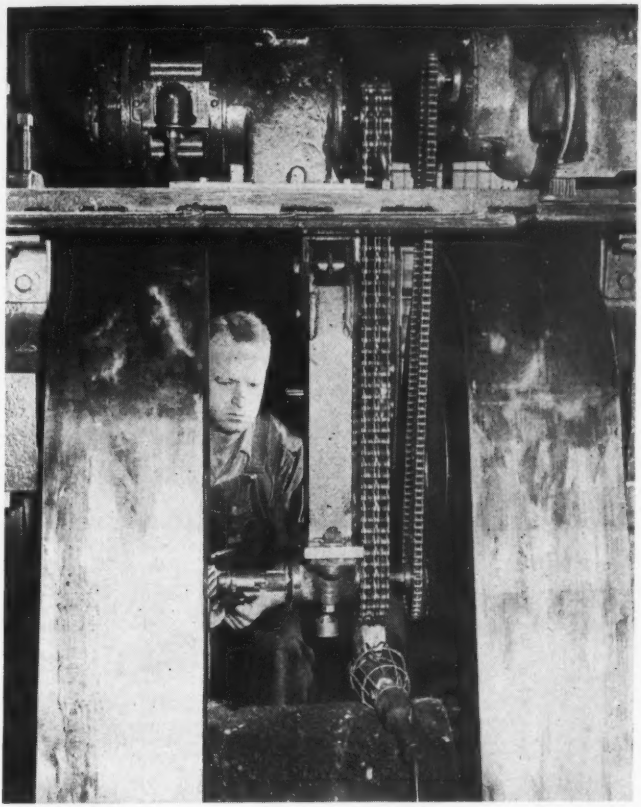


Fig. 15—Drilling and Reaming Holes for the Dowels which Maintain Correct Alignment of the Crankshaft Webs in Service, using a Special Hendy-Built Portable Drilling Machine

tapped for Allen setscrews.

The illustration Fig. 16 shows the operation of milling the keyways for the eccentrics which are cut in the crankshafts with the aid of a portable keyway miller. An end milling cutter is used, held in a vertical spindle which can be fed by hand both vertically and horizontally so as to obtain the proper depth and length.

The tool is positioned on the shaft by means of a huge hinged clamp which locks around the shaft. Portable tools of the type shown and described here simplify the task considerably, because it is much easier to move such tools to the job than it would be to move huge work to the several machines.

Following the cutting of the keyways, the two major parts of the shaft are brought together on a lining-up stand and a portable line reamer is used to finish the flange bolt holes to size and in correct alignment. With this fixture, tolerances under 0.001 inch are consistently achieved, permitting interchangeability of bolts.

Flanges are machined in pairs, and the matching sections are always kept together until their final assembly on the ship. After the flanges have been bolted together, with jacks installed between the webs to hold them in perfect alignment, the entire shaft is moved to the finishing department. Here counterweights are bolted to the webs, the shaft is swung into the big lathe shown in Fig. 17, and a smooth, even finishing cut is taken.

The illustration Fig. 18 shows the

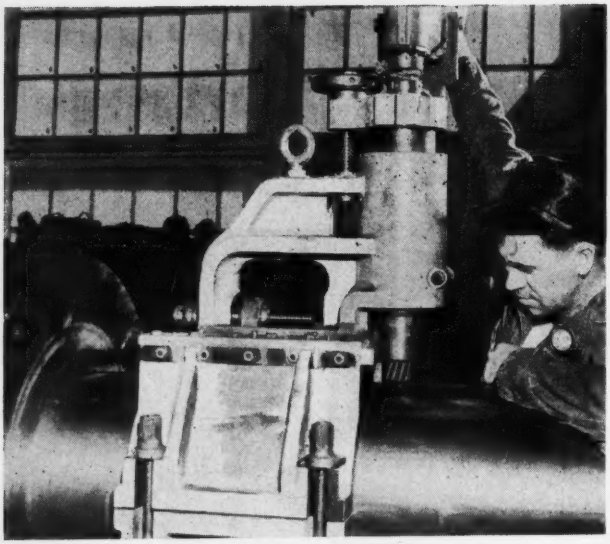


Fig. 16—Milling Keyways in the Crankshafts for Eccentrics, Using a Portable Milling Machine

operation of tapping the steam intake valve on a high pressure cylinder for a C-3, 8,500 h. p. steam turbine, using a 3-inch Geometric collapsible tap for the job. Such a tap eliminates possible damage to the thread, since it can be withdrawn without having to back it out as is the case with solid taps. The radial drilling machine is ideal for this operation, also, because in addition to

Fig. 17—With Counterweights Bolted to the Webs, the Crankshaft is Swung into this Lathe and the Finishing Cut is Taken

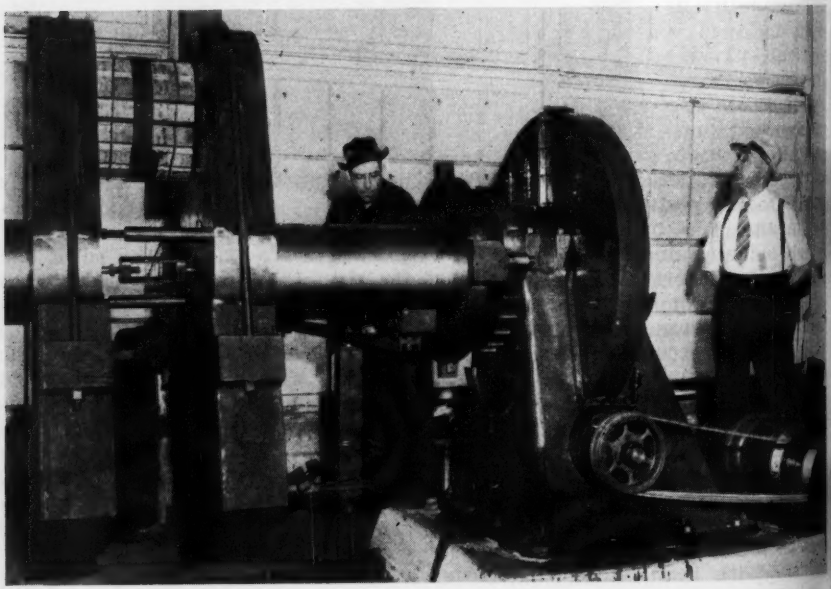
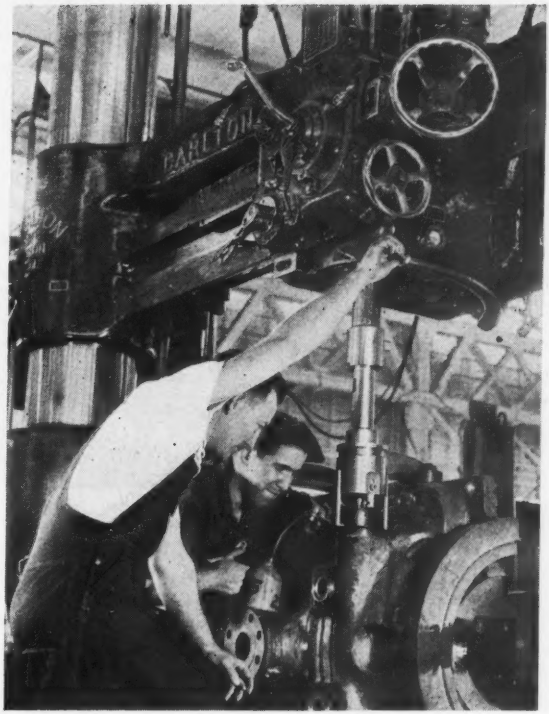


Fig. 18—Using a Radial Drilling Machine and Collapsible Tap to Tap the Steam Intake Valve on a High Pressure Cylinder for an 8,500 H.P. Steam Turbine



having the power necessary to drive such a large tap, it has practically instantaneous control in all directions.

Instead of using the conventional methods for cutting blade-ring grooves in the rotors of the low pressure cylinders for the 8,500 h. p. C-3 steam turbines, Hendy reverses the direction of the lathe spindle and sets the cutting tools upside down as shown in Fig. 19. This method has several advantages; it makes the cut immediately visible to the operator, it tends to eliminate chatter and to steady the work, it frees the tool from the weight of the spindle and prevents "digging in," and it allows the chips to fall away instead of piling up above the tool in position to damage the work.

The 14 grooves to be cut vary in depth from ¾ inch to 2 inches and

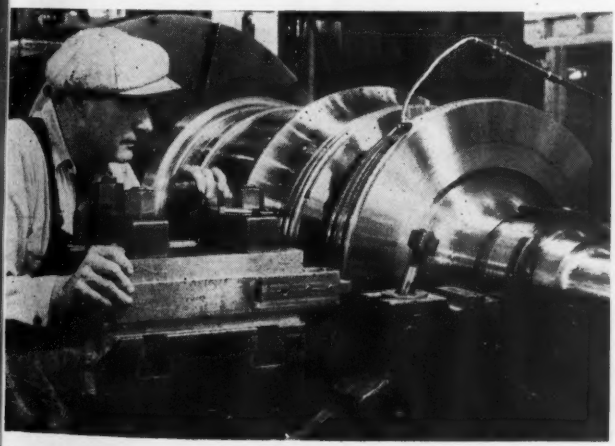


Fig. 19 — To Cut Blade-Ring Grooves, the Tools are Set Upside Down and the Lathe Spindle is Operated in Reverse Direction

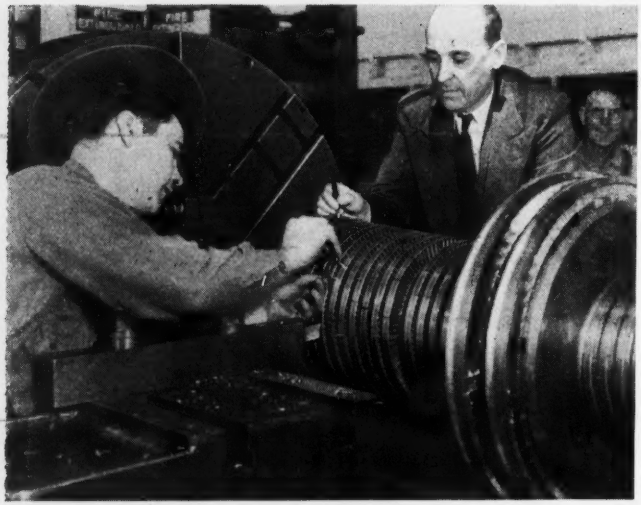


Fig. 20 — Machining Shroud Strips on a High Pressure Turbine Spindle to the Correct Width. Extreme Accuracy is Necessary so that Steam may be Conserved

in width from 0.289 inch to 0.876 inch, with varying widths of undercuts. High speed steel is used for the tools used to cut the straight groove, step groove and undercut. The undercuts are both roughed and finished, but for the straight and steep cuts, use of finishing tools alone has proved highly successful in obtaining accuracy and finish.

Due to the high speeds at which the spindles for the steam turbines rotate, it is necessary that every spindle be in perfect balance before it is assembled to its engine.

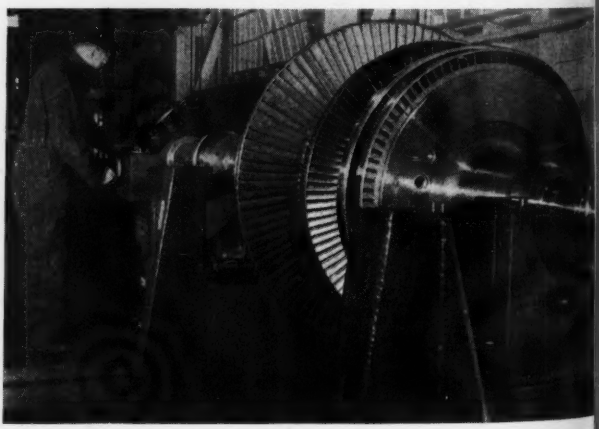


Fig. 21 — Testing a Spindle for an 8,500 H. P. Steam Turbine for Balance. This Machine Locates the Exact Point of Unbalance

The balance is tested by running the spindle at operating speed while it is supported in two floating bearings that are set on knife edges in the bearing columns. In principle, the balancing machine consists of a motor, a set of reduction gears, a shaft, the two floating bearings, arms leading from the bearings to pickup coils in which impulses are set up by the movement of the arms, and special electronic devices which record, segregate, and analyze the impulses as a basis for computations by which corrections will be made.

The balancing process is usually begun by adding a known unba-

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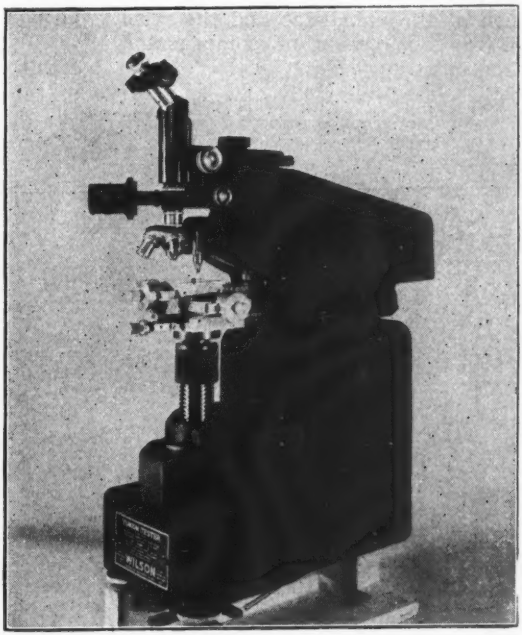

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The KNOOP Indenter is a diamond pyramid that makes an indentation of diamond shape having one long diagonal and one short diagonal and the long diagonal is measured under the microscope.

The specimen is carried on a 2-way type of mechanical stage called the "Microton," by which it is moved both laterally and back and forth to positions under the indenter and the microscope.

The long diagonal varies with hardness and load from 20 microns to 1000 microns and depth of indentation is about 1/30 of long diagonal, so truly surface hardness can be measured.

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ancing weight to the component to be balanced—say three ounces—and setting dials and scales against this known figure, which provides an index for subsequent checking of the unweighted piece. The electronic devices, reacting to the impulses of the pickup coils, report the exact location of the unbalance and the result of the application of compensatory treatment.

Fig. 22—The Exact Amount of Metal that should Be Removed to Balance the Shaft is Removed by Drilling with the Equipment Shown Here

Frequent checking of the dimensions of the shroud strip on a high pressure spindle for a C-3 turbine, as shown in Fig. 20, is a part of the process of facing the shroud strips to specified widths so that the proper clearance can be guaranteed as they revolve at close to 6,000 r. p, m. between the fixed blade rings in the cylinder casing. Extreme accuracy is essential since clearances are kept very small in order that all possible steam energy may be utilized. This is one of the final processes before the balancing of the spindle.

In the illustration Fig. 21 a low-pressure spindle for an 8,500 h. p. C-3 steam turbine is shown undergoing a balancing test in one of the three dynamic balancers in the Hendy machine shop. This machine has a capacity of from 2 to 12½ tons; the other two handle work of from 130 pounds to 1½ tons and from 0 to 1,000 pounds. The smallest one is so sensitive that it picks up unbalances of as little as 0.000025 ounces, though most of the balancing averages to 0.0 ounce.

After the degree of unbalance in a part has been computed on a dynamic balancing machine of this type, and the location of the point of unbalance has accurately been determined, the balancing process in a basis of right and left - hand planes. A drill is used, as shown in Fig. 22, to remove the exact amount of metal required from the right plane of the spindle along a previously-indicated correction line, and the balance is then further corrected on a similar line on the left-hand plane surface of the spindle, the process being continued until a dead balance down to 1/100 oz. or better is obtained.

In the case of large gears, unbalance is compensated by adding carefully-calculated amounts of metal plate to the inside of the fabricated wheel. Rotors are meticulously balanced when blading starts, but the

Fig. 23—Stand for Testing Turbo-Generator Sets. Eight Sets may be Tested Simultaneously on this Stand

addition of the multiple rows of blades with spacers, locking devices, and shroud strips, plus the riveting of the shrouds, inescapably sets up variations in balance which must be adjusted, despite the exacting care which has gone into the machining of all the parts.

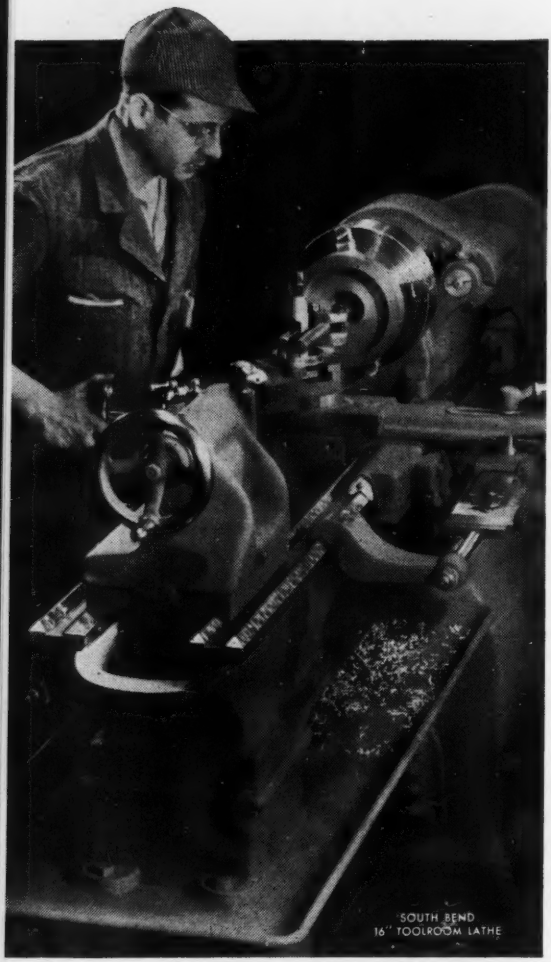
All rotors and gears (with the exception of the 147-inch C-3 turbine bull gears) are balanced on these machines. In the case of rotating parts for the 300-kw turbo-generator sets, the individual busket wheels of the spindle are statically balanced, but when the spindle is assembled on its shaft and joined with the pinion-gear spindle (which has already been dynamically balanced), the whole assembly is placed on the machine for final balancing.

Testing of the spindles and larger gears is usually done at a speed of 300 r. p. m. instead of at the known critical speed. Since the same elements of flutter or vibration are present at 300 r. p. m. as at the critical speed (say 5,000 r. p. m.), the same effect may be achieved at the lower speed by electronic amplification of the minute impulses. Smaller parts are tested at an average of 400 to 500 revolutions per minute.

Eight turbo-generator sets may be tested simultaneously on the test stand shown in Fig. 23, which also has facilities for the testing of larger main-propulsion engines. Sets are run at full load with a special testing and checking of all safety devices, actual operating conditions being reproduced in every respect. The special boiler supplies steam at 400 pounds pressure and 750 degrees superheat. It can, however, produce pressure up to 1200 pounds. Hendy-built turbines are put through a regular sequence of operations and must prove themselves under conditions far more severe than those they can normally be expected to encounter in service. In consequence, Hendy has established an enviable reputation as a builder of dependable engines.

PRECISION

— AS VITAL IN WAR AS IN PEACE



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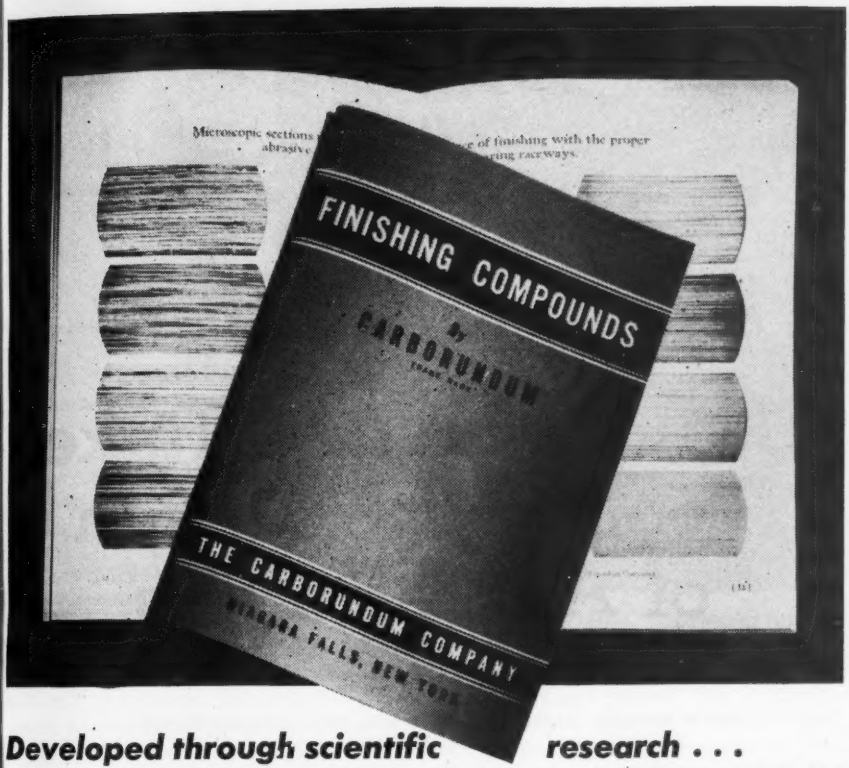

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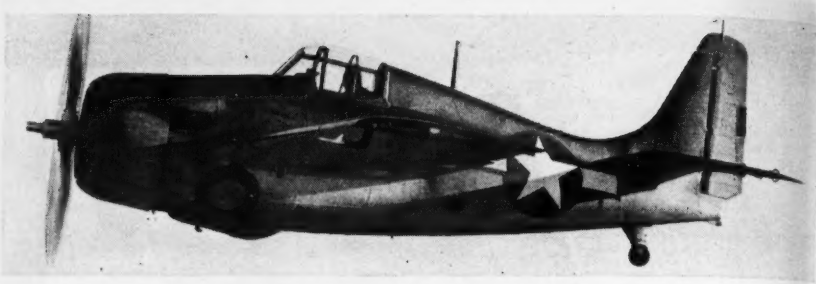


"Wilder Wildcat" Carrier-Based Navy Fighter Plane built only by Linden Division of General Motors Corporation

Use of Negative Rake Tools in Production of Aircraft Parts

By J. Q. HOLMES*

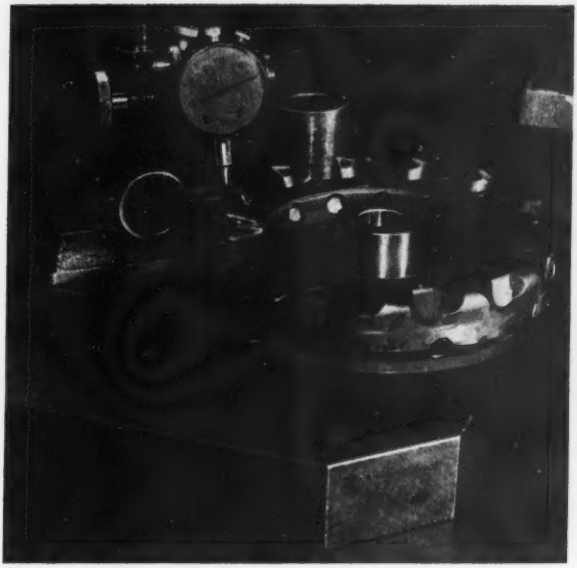
Master Mechanic, Eastern Aircraft Division, General Motors Corporation, Linden, New Jersey

EASTERN Aircraft is one of General Motors' newest divisions. It was formed in January 1942 for the sole purpose of producing planes for the United States Navy. The personnel was recruited from many of the Corporation's other divisions. In all, 47 plants were called on for men. They came from plants from the Pacific to the Atlantic Coasts. These men had no aircraft experience prior to the start of this project. However, they were experienced in manufacturing problems. With these men for a start, people were hired and the personnel built up.

The Linden Plant, with which the speaker is connected, builds the "Wilder Wildcat"—or FM-2—as it is designated. This is a carrier-based folding-wing fighter plane produced exclusively by General Motors. The Wildcat is built completely by Eastern Aircraft with the exception of government-furnished parts such as engine, guns, radio and so on.

Because of the high stresses in this product almost all structural parts that require higher physical strength than can be obtained with Aluminum Alloys are made from Chrome Molybdenum Steel such as 4130-4140 and Chrome, Nickel, Moly Steel such as 4340. These parts are machined in three conditions; namely, annealed, normalized and heat-treated.

* Read at semi-annual meeting of A.S.M.E., Pittsburgh, Pa., June 20, 1944.



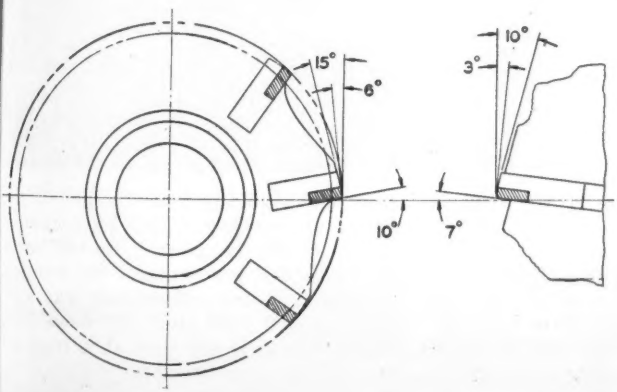
Inspection of Finish-Ground Cutters. Teeth are Held to Uniform Length Relative to the Mounting within 0.0003 to 0.0005 Inch

The annealed runs
100,000
17 C Rockwell
The normalized runs
120,000 PST
24 C Rockwell
The heat-treated runs
180,000
40 C Rockwell

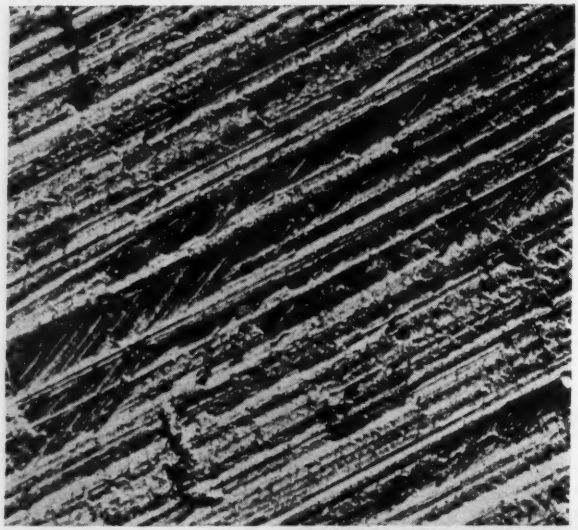
This discussion basically deals with the machining of those steels. The condition in which the pieces are machined is determined by the use, the limits to be held and the amount of warpage that develops as a result of heat-treating.

Negative rake cutting was investigated late in the year 1942. One of the manufacturers of tungsten carbide told us of the performance of such tools and left us a circular describing the method. Of course, our first reaction was typical: "We knew it couldn't be done." However, one of the first things we were told in airplane work was that "one didn't have to be crazy to build planes, but it surely helped," and having learned that many new ideas would work, we decided to order a milling cutter of the negative-rake type.

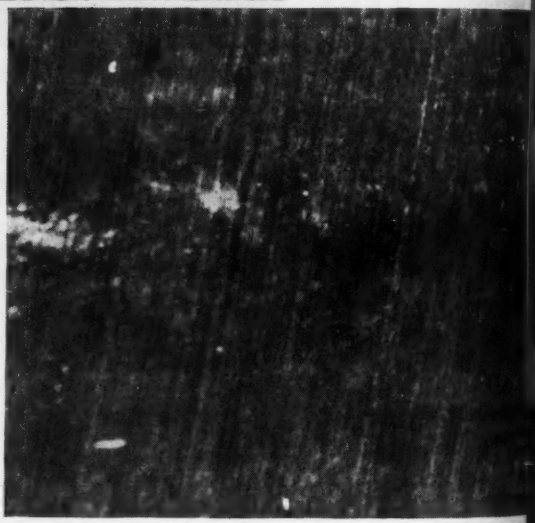
Following the recommendation of the carbide manufacturer we ordered one 6-inch diameter inserted blade face mill with negative helix and negative rake. The cutter manufacturer at once "knew" we were screwy and



Drawing of Typical Grind Used on Negative Rake Milling Cutters. A Print of this Drawing is Posted in the Grinding Room for the Guidance of Operators



(Above)—Micro-Photo of the Finish Obtained by Conventional Milling on 4130 Steel, X10



(Below) — Finish Obtained with Negative Rake Tools on 4130 Steel, X10

little over previous cuts. Since this meant little increase in production we started to increase feeds as the speed went up, holding the chip to a thickness of about 0.002 inch per tooth per revolution.

All this time the chips came off like a snow storm, but red hot—so hot that the wood block

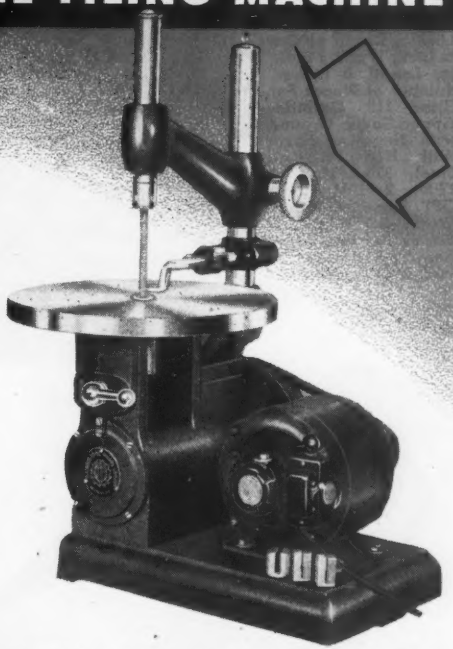
advised us they could make us such a cutter "if we wanted it," but politely questioned its design stated that, if made, no such cutter would be guaranteed. We assured them that we did want this cutter and would not hold them responsible for its performance.

When the cutter came in, the representative of the carbide manufacturing company came in to see it tested. The test was run on a No. 5 Milwaukee Vertical Mill, which was selected because it was one of our heavier machines. At his recommendation, cutter speed was set high but the feed per minute was only a

floor was smoking from the hot chips. When we reached a then phenomenal speed of 1000 feet per minute and feed of 21 inches per minute, we decided to call it a day. This test was run on annealed 4130 steel which we had been milling every day at a feed of 1½ inches per minute.

3 JOBS WELL DONE *on the*

ILLINOIS DIE FILING MACHINE



RAPID AND ACCURATE PERFORMANCE OF CRITICAL FINISHING OPERATIONS

PRECISION and BALANCE mark the Illinois Die Filing Machine which is designed to save time and do a superior job on finishing intricate die shapes. Convenient and adaptable, it is built with extreme precision and durability. Working parts are hardened and ground for accuracy and long life. Automatic forced feed lubrication reduces wear to a minimum. The Illinois Die Filing Machine relieves tedious hand filing of intricate shapes and assures greater accuracy at lower cost. Write for descriptive literature, today!

Overnight to All America . . . From the Hub of Air Transportation.

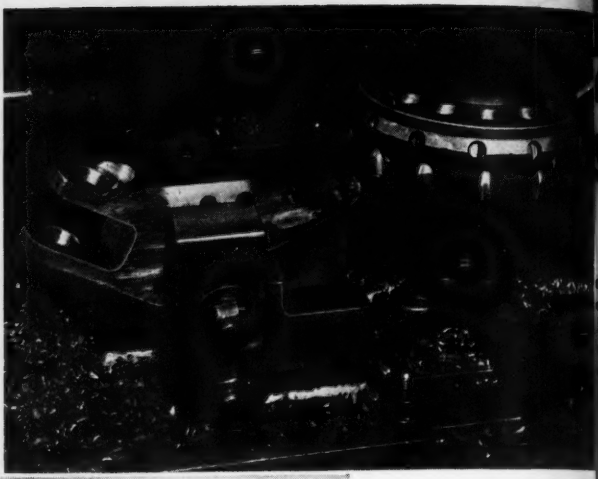
ILLINOIS TOOL WORKS

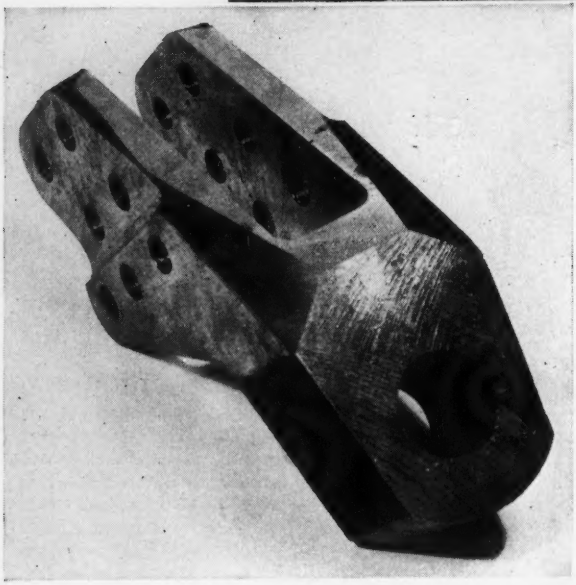
2501 N. KEELER AVE. CHICAGO 39, ILLINOIS

In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario.

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

Set-Up for Machining a Wing Hinge Fitting. Material, 4130 Steel; Tensile Strength, 105-000 PSI. Run on a No. 5 Vertical Mill; Speed, 400 RPM; 838 SFPM; Feed 21 IPM; CPT 0.00375; Depth of Cut ⅜ Inch; Width 3 inches; Length 5 Inches. Number of Pieces Per Grind, 119. Carbide-Tipped Tools, Ground with Negative Rake. With High Speed Steel, 37 RPM; 77.5 FPM; 2 IPM; 0.004 CPT. Same Depth and Width of Cut, 97 Pieces Per Grind. HP Required, 13.4 at 21 Inch Per Minute Feed





Photograph of Finished Wing Hinge Shown in Work in the illustration above. Note that Surface Around Hole is Cut with High Speed Steel Producing Conventional Finish. Speed 12 RPM; 41 SFPM; 7/16 IPM; 0.0014 CPT. Soluble Oil Used. Surfaces Adjacent to Slot Were Machined with Negative Rake Cutter Using No Coolant. Speed 326 RPM; 1024 SFPM; 9[illegible] IPM; 0.0007 CPT; Depth of Cut 4½ Inches; Width 1[illegible] Inch; Length of Cut 4 Inches

The results of this test proved to us that we really had "something;" what, we didn't know. It was decided to use this cutter and find out if this was an application of a really usable tool. Weeks of test continued. Different grinds were tried; tips were broken and replaced, proving one thing — inserted blade cutters were desirable.

While this test work was taking place, economic problems arose. Machinery was scarce and delivery of new machines slow. Our production schedules were increasing. The Navy wanted more—always more. Man power was scarce too, and often when a man had been trained to a point where he was producing, we would lose him to the draft.

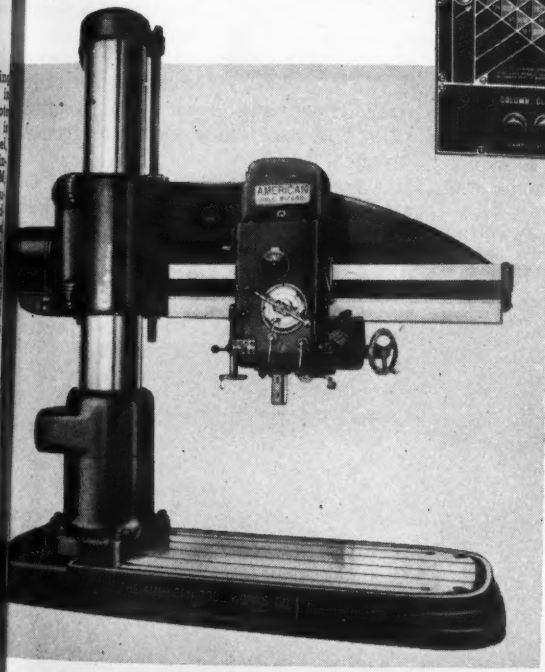
All these problems proved to u

32 SPINDLE SPEEDS

...with only 2 Control Levers and 1 Back Gear Lever

Operators are enthusiastic in their praise of this new direct reading speed control. They don't have to refer to index plates or retain lever positions in their minds when making speed changes. Its superiority and convenience encourages operators to use correct speeds for their work. Being direct reading, operators are not fearful of making mistakes.

The entire range of 32 spindle speeds is secured through two opposed vertically operated levers which are direct reading and one two-position back gear lever used only when changing from the high to the low speed range or vice versa.



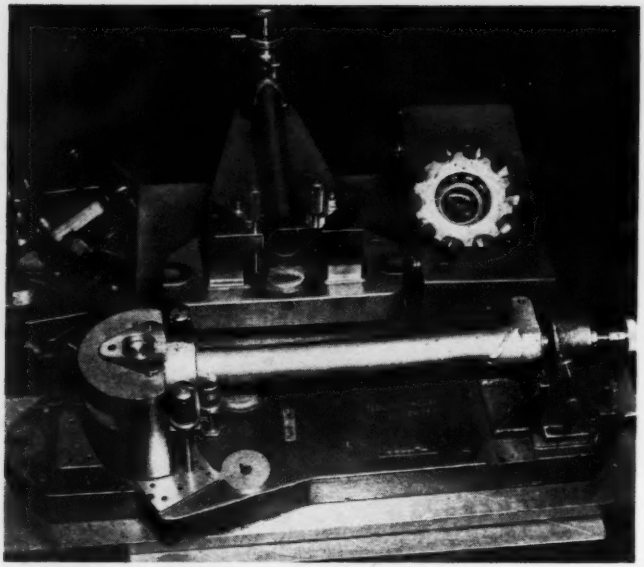
This new speed control makes work easier; increases production because of it and the payroll dollar buys more as a consequence.

This and other fine features of the "American" Hole Wizard Radial Drill are thoroughly illustrated and described by Bulletin No. 326.

THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

Lathes and Radial Drills



Fixtures and Cutt
Used for Machinin
Landing Gear Str
Material, 4130 Ste
Tensile Strength, 1
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Face Milling; Tw
Surfaces Shown. Ne
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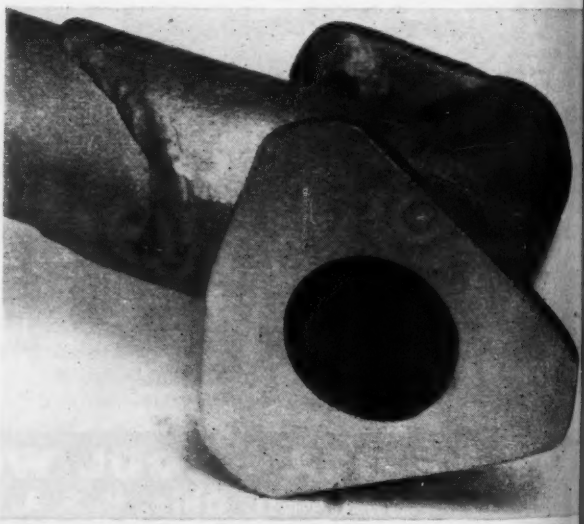
Tipped Cutter; Spe
400 RPM; 833 SFP
Feed 21 IPM; 0.00
CPT. Depth of Cu
3/32 Inch; Width o
Length 3 x 3 Inche
158 Pieces Per Grin
This Operation R
quired 4 HP wi
Sharp Cutter and
HP with Dull Cut

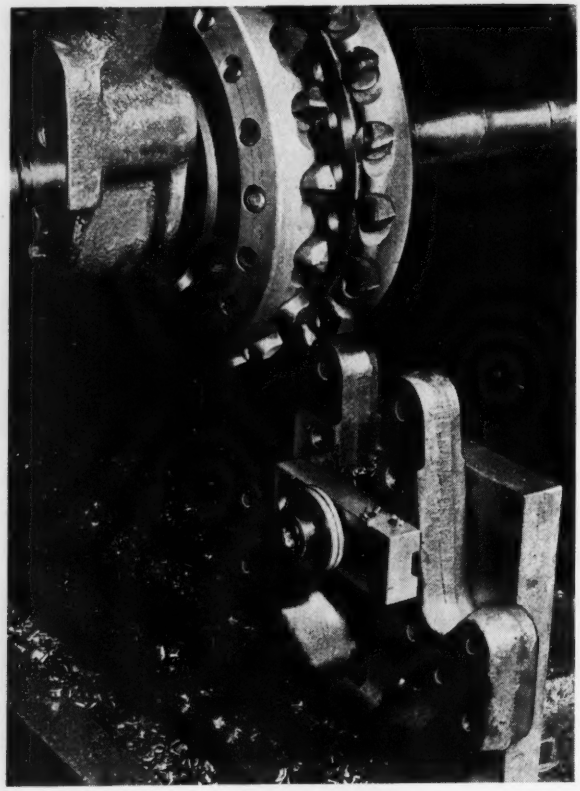
that if parts could be run in production at the speeds found satisfactory in tests, we could produce more on our existing machines and tools and use less man power.

Our tests had shown us another desirable improvement — Finish! While we do not need the finish required in aircraft engine work, a good machined finish is desirab
Our tests show
that with neg
tive rake too
finishes wer
much superi
over those produced with 'positi
rake. In fact; they look like grou
finishes.

All of these findings convinced
that we should put this new meth
into production. Please keep in mi



Close - Up Showing Milled Surfaces of One End of Part Shown in Previous Illustration. This Part was Designed for Heavy Stress, Being an Assembly of a Chrome-Moly Forging and a Piece of Tubing Welded Together and Heat Treated. The Milled Surface is Held to 0.0015 Inch with Respect to the Milled Surface on the Opposite End



Close-Up of Straddle Milling Operation on a Lock Fitting that Holds the Folding Wing in Position. This Part is Extremely Important. Material, 4140 Steel; Tensile Strength, 105000 PSI. Fixture Shown was Too Light for Job; Fixture has Since Been Rebuilt. Cutter, Carbide Tipped, Negative Rake. Speed, 247 RPM; 623 SFPM; 15 IPM; 0.020 CPT; Depth of Cut ⅛ Inch; Width 1¼ Inch; Length 1¾ Inch. Pieces Per Grind, 10

that our sole reason for existence was to build more planes for the Navy and build them always better. We were not interested in the development of a new method, either from a sales angle or from a problem in research or engineering. Just one thing—to get the "most of the best for the least."

The adoption of such a program met with considerable resistance. Our people thought that such speeds were merely stunts. At first our operators were afraid, due to the large quantity of hot chips that flew from the work. The use of Safety Goggles was required. Speeds and feeds would be maintained while the Tool Engineer was present, but as soon as he left, the feed would be reduced.

We now have about thirty jobs running with negative rake tools, including milling, turret lathe and precision boring work, some of which will be shown a little later in this discussion.

The milling operations are face milling, straddle milling and slotting of steel. To date no tests have been run on slab mills, the reason for this being that the cutters are quite difficult to tip with carbide. All of these milling jobs have shown remarkable increases in production. Feeds have been increased from a range of $\frac{7}{16}$:2 to 5½:30 inches per minute. Ratio of decrease in cutting time is 10:15 to one. In fact, cutting time has been reduced to such a point that it is but a small part of the total time required on an operation.

To really take maximum advantage of this cutting speed, automatic loading or indexing fixtures should be built. We have not gone into this as aircraft production does not justify such tool expense. However, the information gained will be of great value in automotive tooling.

The turret lathe jobs are turning

SPEED — PRECISION ECONOMY

. . . PLUS HYDRAULIC VERSATILITY FOR QUICK CHANGE-OVER TO NEW PRODUCTS

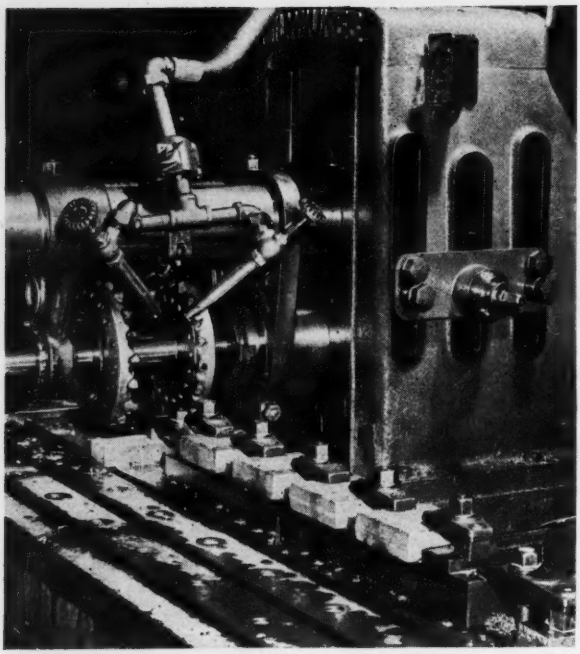
...lly automatic ...th hydraulic ...olding equip- ...ment, feeds, tail- ...stock quill. Swing ...over bed 15", over ...carriage 8", be- ...tween centers 30".

Designed especially for carbide tools, the Lipe Carbo-Matic Lathe gives you full advantage of modern "man-made diamond" cutting tools. It has the rigidity and brute power for fast, heavy hogging or intermittent cuts on high brinell steels . . . the high spindle speeds for efficient precision finishing to tolerances as close as .0005" . . . and the automatic "know how" which carries a cycle to completion without help from the operator. Labor costs, tool costs and scrap costs are lower. Adjustment, cleaning and re-setting are simpler.

It has the versatility for quick change-over to new products or parts. Feed rates, traverse rates and sequence of motions are hydraulically controlled, permitting almost infinite variation. Speed changes range through 198 different steps from a low of 59 to a high of 3,100. It is a lathe you can rely on . . . a lathe that will give you the very qualities you'll need most in a post-war world of change, obsolescence and new products.

ARMY E NAVY

LIPE-ROLLWAY CORPORATION
SYRACUSE 1, N. Y.



Straddle Milling Operation on Wing Reinforcement Angle, Using Negative Rake Cutters. Speed, 200 RPM; 471 SFPM; Feed 20 IPM; 0.0055 CPT; Depth of Cut, 1/8 Inch; Width 1¼ Inch; Length 4½ Inch. Pieces per Grind, 144. Note that This Machine is Running at Much Lower Speed than Other Operations Described, which is Due to Fact that 200 RPM is Maximum Speed Obtainable with Present Gears. New Gears Have Been Ordered. Flat Surfaces on These Parts were Machined on a No. 5 Vertical Mill, Using a Negative Rake Cutter at 400 RPM; 838 SFPM; Feed 25 IPM; 0.0045 CPT; Depth of Cut ⅛ Inch; Width 4 Inches; Length 4½ Inches. Number of Pieces Per Grind, 149. 138-Pound Flywheel Was Used on Spindle. This was the Only Job Run with a Coolant When Using Negative Rake Tools, Coolant Being Desirable on this Set-up Because of the Slow Speed

and facing. As shown in the illustrations, these jobs often involve intermittent cuts. Cutting time has been reduced, however, since these jobs are running two to four times faster with feed increases of two to three times. Speeds of 400-500 SFM are used with feeds of 0.009 inch per minute compared with 0.003 inch. Several parts that were previously ground are now bored on Heald Borematics. Many of these parts are about 40 Rockwell "C."

The grinding of tungsten carbide tools for this work must be done carefully. We have found by test that the best angles for our work are 7 deg. negative helix and 10 deg. negative rake, on face mills, and all our milling cutters are ground to these angles. It is imperative that these cutters be finish-ground with

With Rotary Files, the world's foremost file manufacturer now extends still further the scope of the well-known Nicholson slogan, "*A file for every purpose.*"

After thorough study of the fast-growing uses of Rotary Files, Nicholson is prepared to provide both *Hand Cut* and *Ground-from-solid* types.

Each type is available in 16 standard styles or shapes; 3 cuts (Coarse, Medium and Fine); 64 sizes and in diameters ⅛" to 2".

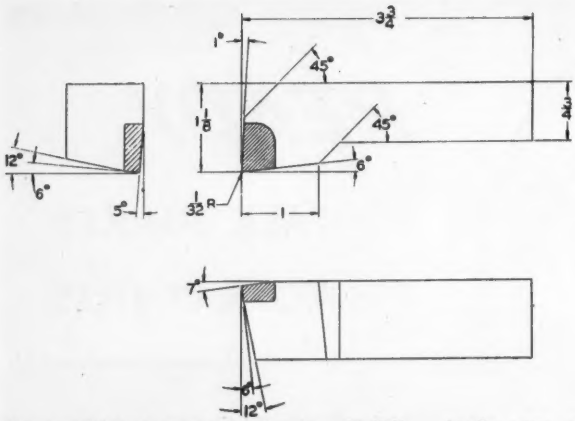
For easy identification, each file shank is code-stamped to conform with Catalog and Price Sheet listings.*

Nicholson Rotary Files are manufactured from high-speed steel. Carefully shaped and true centered. Accurately cut or ground. Expertly hardened. . . . In every respect, upholding the Nicholson tradition for *The right file for the job* in the highest quality obtainable.

***SEND FOR CATALOG AND PRICE LIST.** Write us for any special information. For deliveries, consult your mill-supply house.*

Nicholson File Co., 48 Acorn St., Providence 1, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON FILES
FOR EVERY PURPOSE
NICHOLSON U.S.A.



Drawing Showing Typical Grind for Carbide Tipped Facing Tool of the Type Used on Turret Lathes. Note Negative Side Rake and Negative Back Rake

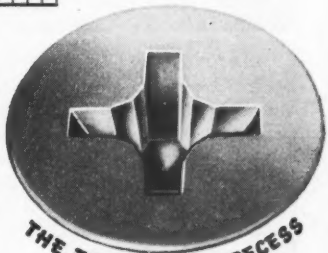
diamond impregnated wheels. If Silicon Carbide is used, the wheel breaks down before the cutter is finished, and the teeth are of unequal length. With diamond wheels the teeth are held to the same length within 0.0003 to 0.0005 inch. After grinding, cutters are inspected to see that this dimension is held.

Spindles must run true and the cutters must be checked for un-out after mounting on the machines. While the same problem is not encountered with lathe tools, we rough-grind with Silicon Carbide wheels and finish with diamond wheels of 180 grit.

The grades of carbide used play an important part in the performance of the tools. We have used two grades; one for milling and turning, and another for facing when intermittent

WHEN THIS → WANTED Assembly Workers DREW A BLANK

THE BOSS TORE HIS HAIR UNTIL SOMEONE WISED HIM UP TO THIS → → THE RECESSED HEAD SCREW THAT UPS DRIVING SPEED AS MUCH AS 50% IT'S PHILLIPS



Stymied because you've just got to boost assembly department output and you can't hire more workers to do it? No need to be!

You can boost output another way – by switching to Phillips Recessed Head Screws. They will increase driving speed as much as 50 percent. They have done it for hundreds of plants!

With Phillips Recessed Head Screws, your workers encounter none of the troubles that cause slow driving. Spiral and power driving can be used where speed tools have always been impractical. And, the work becomes so much easier that assemblers can maintain a fast pace throughout a shift.

Switch to Phillips Recessed Head Screws. You'll find they'll give you faster driving, easier driving, greatly increased output. You'll also find they *cost less to use!*

TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

IDENTIFY IT!

Faster Starting: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

Faster Driving: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

Center corners of Phillips Recess are rounded . . . NOT square.

Easier Driving: Turning power is fully utilized. Workers maintain speed without tiring.

Bottom of Phillips Recess is nearly flat . . . NOT tapered to a sharp point.

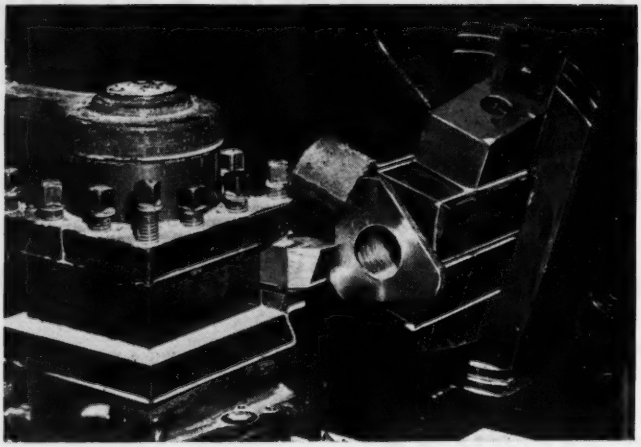
Better Fastening: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.

PHILLIPS Recessed Head SCREWS

WOOD SCREWS · MACHINE SCREWS · SELF-TAPPING SCREWS · STOVE BOLTS

24 SOURCES

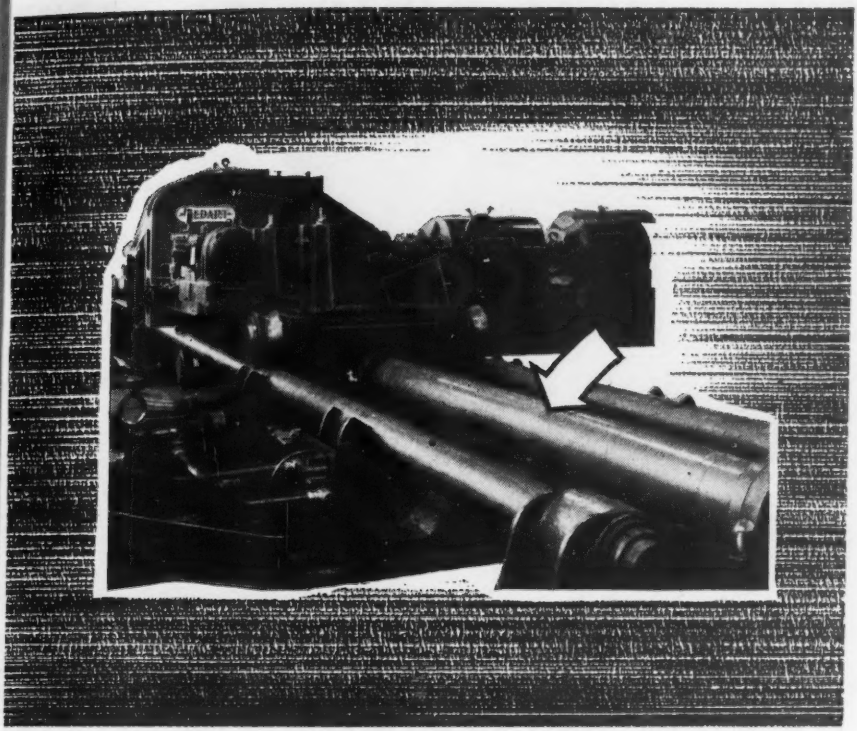
American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford River and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Parmenter Screw Co., Pawtucket, R. I.
Thrift Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Wolverine Bolt Co., Detroit, Mich.



Turret Lathe Set-up for Machining Fitting Used on One End of Landing Gear Strut. Cutting Compound is Used on all Lathe Operations on Which Negative Rake Tools are Used. Material 4130 Steel in Normalized Condition. Type Intermittent Cut. Work Speed, 45 RPM; 356 SFPM; Feed 0.009 IPR; Depth of Cut ¼ Inch; Number of Pieces Per Grind 0

cuts are made. Several makes have been tried and while we feel that there is a big field for tests on cutting grades, we are not doing much with it as we are getting excellent results from these two grades.

Much has been written on the subject of tool lead and number of teeth. Our work has been done with chip under 0.005 inch per tooth per revolution. At first, our speeds were higher than at present up to 1285 FPM with chip of 0.002 inch. Now we are running speeds from 800 to 1000 FPM and chip thickness up to



Hydraulic Power for big jobs

This Medart Billet Peeler, capable of peeling or scalping round steel billets in sizes up to 13 in. diameter, uses powerful, easily controlled hydraulic action for clamping the billet in the carriage, and for advancing the carriage as the billet goes through the rotating cutter head. Hannifin precision hydraulic cylinders are used by Medart for both these applications. The carriage cylinders are an example of Hannifin ability to build large, long stroke hydraulic cylinders to precision standards. These cylinders are 11 inch bore x 144 inch stroke. Just as in the smaller sizes, these cylinders are bored and honed to produce a mirror finish cylinder body—for maximum power, smooth action, and long life.

Bulletin 35 describes Hannifin hydraulic cylinders. Write for your copy. Hannifin Manufacturing Company, 621-631 South Kolmar Avenue, Chicago 24, Illinois.

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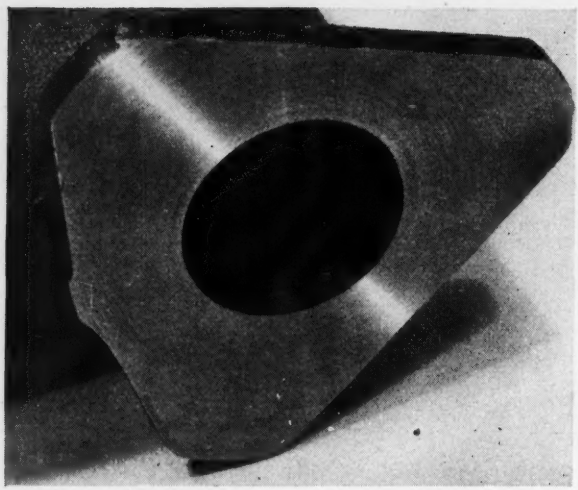
Hannifin

HYDRAULIC CYLINDERS . . .

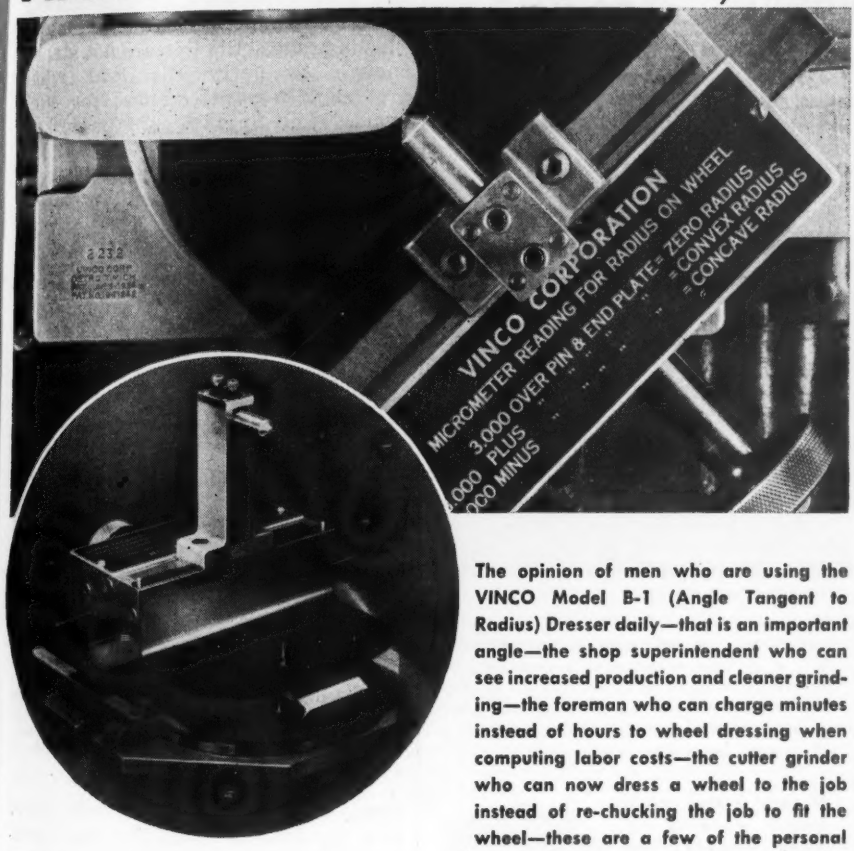


Close-Up View of Finished Piece Shown in Operation in Previous Illustration

0.0045 on milling. Most of our mill cutters are 6 inch diameter with 10 teeth or 8 inch diameter with 14 teeth. These have more teeth than many people think proper. Again let me emphasize that we are getting excellent results — which are what we want!

In the examples to follow, comparison is made between carbide tipped milling cutters with negative rake and high speed steel with positive rake. You may ask what is the comparison between negative rake and positive rake cutters with the same grade of carbide? We have never made that comparison because we never have been successful in the use of carbide milling cutters with positive rake on steel.

THERE ARE OTHER ANGLES, TOO



The opinion of men who are using the VINCO Model B-1 (Angle Tangent to Radius) Dresser daily—that is an important angle—the shop superintendent who can see increased production and cleaner grinding—the foreman who can charge minutes instead of hours to wheel dressing when computing labor costs—the cutter grinder who can now dress a wheel to the job instead of re-chucking the job to fit the wheel—these are a few of the personal angles that are largely responsible for the rapid increase in the VINCO B-1 Dresser acceptance. Write us direct or consult our District Sales Offices for any further information.

Sub bases will be furnished (at slight additional cost) for most types of external and internal grinders. When ordering, specify the machine or machines on which the dresser will be used. This will enable us to advise you correctly on the type of base best suited to your specific needs.

VINCO CORPORATION, 8861 SCHAEFER HIGHWAY, DETROIT 27, MICH.

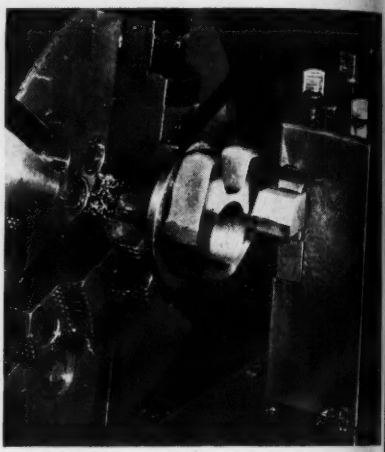
SALES OFFICES— NEW YORK CLEVELAND CHICAGO

MILLIONTHS OF AN INCH FOR SALE BY VINCO

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Hub Gages • Built-up and Special Gages • Gear Lapping Fixtures • Spline and Index Fixtures • Hydraulic Power, Control, Utilization and Distribution Units • Engineering, Design and Development

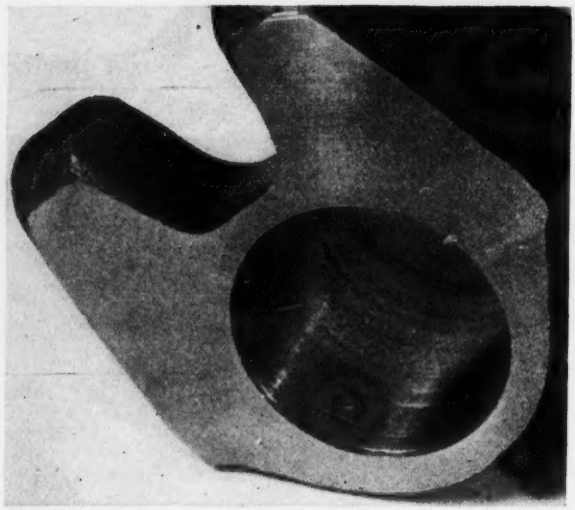
The experience of the author and his associates over a period of years has been failure of carbide milling cutters with positive rake on steel. This is because the tips are not strong enough to carry the lead when ground with positive rake; for such grinds, High Speed Steel is more satisfactory.

Carbide has, of course, been used with positive rake in milling aluminum, and to date we do not know of a top limit of speed for this work. Our recent experiments on milling aluminum with negative rake indicate that it will be possible to use the same cutters for aluminum as for steel. The advantage of this is better finish and reduction of cutter inventory.



Turret Lathe Set-Up for Machining Opposite End of Landing Gear Strut Shown in Previous Illustrations, Using Negative Rake Tool. Speed, 475 RPM; 356 SFPM; Feed 0.009 IPR; Depth of Cut, ¼ Inch; Pieces Per Grind, 69.

We have done some test work on chip loads up to 0.008 inch but find on our mills that the spindles are light for this load. We are using No. 3, No. 4 and No. 5 knee-type mills in most cases. An exception is a duplex mill on a straddle mill job.



Finished Part Shown in Work in Previous Illustration. Note Intermittent Cut

This machine has a top speed of 200 RPM, but even with this we have increased our feed to 20 inches per minute over a previous 1 to 2 inches.

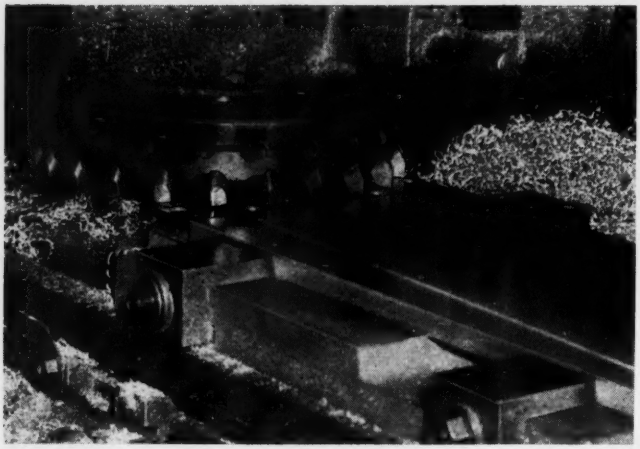
We are testing fly wheels on the cutter end of the spindle to see if heavier cuts can be taken. We feel that with heavier machines much more can be done than we have done with our present machines.

Many people have asked about power requirements. As stated before, we are using negative rake tools for production, not research. However, we have installed meters on a No. 5 vertical 20 h. p. machine and have taken power readings.

A wide variety of parts were run on this machine and observations made of the power used. On the parts illustrated, the power consumption was of no consequence. Some of the readings are given in the captions to the photographs.

We found that a great deal of variation exists between dull and sharp cutters. In many of the tests we found that a dull cutter required twice the horse power of a sharp cutter. On one of the tests a sharp cutter required 13.4 horse power motor, even this was not objectionable.

We feel that within the normal capacity of the machine, increase in power for negative rake milling is no problem. This is because with the greatly reduced cutting time, such load occurs for such a short period of time relative to the total time that the motor will carry the overload, if any, without any trouble.



Experimental set-up to test negative rake milling on 24ST aluminum. No trouble has been experienced with positive rake tools on this material. Test was run with cutter ground to same negative rake angle as has been used in steel, and produced satisfactory results. One definite advantage of the negative rake tools on this type of work is the fact that the cutter forces the work down onto the fixture instead of tending to lift it, as is done with positive rake tools.

We have not had any trouble with our motors from heating or from over-load.

One interesting fact was found; namely, when we increased feeds as, for example, from 15 inches per minute to 20 inches per minute on a given job, the increase in power consumed was negligible.

By this time negative rake tools have been accepted by both operators and foremen. They now are interested in seeing other jobs tooled, and are receptive to the method.

In some cases it has had the effect of stimulating operators to higher speeds on other operations. More jobs are being changed to negative rake tooling as fast as tools can be provided. In this plant negative rake tools are no longer experimental.

A fool and his money are soon parted. Be wise; buy Victory Bonds and have your money when you need it.

QUESTION No. 1

Which INCO Nickel Alloy is FREE-MACHINING?

Consult the tables below for comparative properties of these two metals

Answer No. 1...

TOUGH YET EASY TO MACHINE

Engineers and screw machine products manufacturers already know this metal. Introduced several years ago, "R" Monel offers the corrosion resistance, toughness and strength of regular Monel, plus improved machining characteristics.

Readily fabricated by cold forming, "R" Monel is available as hot-rolled and cold-drawn rounds, squares and hexagons. This INCO Nickel Alloy is well suited for automatic production of rust proof screw machine parts, yet has mechanical properties at least equal to steel screw stock (SAE 1112), and is actually *tougher.*

PROPERTIES OF "R" MONEL

Condition	Tensile Strength 1000 psi	Yield Strength (0.2% offset) 1000 psi	Elongation in 2 in. per cent	Hardness BHN 10-mm. ball 3000 kg.
Cold-drawn, annealed	70- 85	25- 40	50-35	110-140
Cold-drawn, as-drawn	80-115	50-100	35-15	150-220
Hot-rolled, annealed	70- 85	25- 40	50-35	110-140
Hot-rolled, as rolled	75- 90	35- 60	45-25	120-170
PROPERTIES OF SAE 1112 STEEL SCREW STOCK				
Cold-drawn, as-drawn	80-100	70-80	20-10	170-20
Hot-rolled, as rolled	60- 80	35-55	40-30	126-15

QUESTION No. 2

Which is free-machining and also HARDENABLE *by* HEAT TREATMENT?

Answer No. 2...

OFFER EXTRA HARDNESS AND STRENGTH

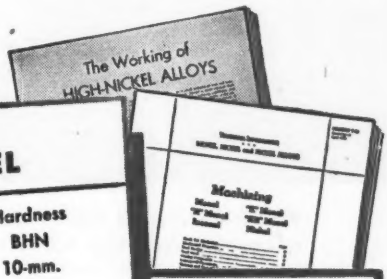
This metal is the latest addition to the family of INCO Nickel Alloys. Its name..."KR" Monel. Like "R" Monel, "KR" Monel combines corrision resistance and strength with improved machining.

But "KR" offers a big plus . . . *through heat treatment this unusual metal develops exceptional hardness and strength.*

A non-magnetic alloy, "KR" Monel is suitable for production of corrosion-resisting parts, and can be heat-treated after machining.

For complete information on these and other INCO *Nickel Alloys, write to:*

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York, N. Y.



PROPERTIES OF "KR" MONEL

Condition	Tensile Strength 1000 psi	Yield Strength (0.2% offset) 1000 psi	Elongation in 2 in. per cent	Hardness BHN 10-mm. ball 3000 kg.
Cold-drawn, as-drawn ...	100-125	70-100	35-15	175-250
Cold-drawn, heat-treated.	140-170	100-130	30-15	260-320
Hot-rolled, as rolled.....	90-120	40- 85	45-30	140-225
Hot-rolled, heat-treated..	135-160	90-120	30-20	260-300

Machining Techniques for both "R" and "KR" Monel are clearly and fully described in Machining Bulletin T-12. Write for as many copies as you can use and also for the reprint "The Working of High Nickel Alloys."

PUBLIC AUDITORIUM, CLEVELAND, OHIO

26th Annual National Metal Congress *and* War Conference Displays

at Public Auditorium, Cleveland, Ohio, October 16 - 20

MORE than 325 manufacturers, state and civic organizations are planning, for the 26th Annual National Metal Congress and War Conference Displays to be held in the Public Auditorium, Cleveland, Ohio, from October 16th to 20th, exhibits that range from ferrous and non-ferrous metals to processes and equipment for their production, fabrication, handling, treatment and use.

Sponsored by the American Society for Metals, in cooperation with the American Welding Society and the Iron and Steel and Institute of Metals Divisions of the American Institute of Mining and Metallurgical Engineers, the National Metal Congress this year will include the American Industrial Radium and X-Ray Society and the Society for Experimental Stress Analysis.

Altogether, some 150 lectures and papers will be presented by qualified authorities in the several branches of science and industry represented by these societies. The technical sessions of the American Society for Metals will be held at the Hollenden and Statler Hotels; the A. I. M. E. will be

Ever count the leaves on a tree? Of course not! But better look close at our picture. It is an accurate diagram of the combinations that can be made up out of the assortment of holders, cutters, and pilots contained in one Gairing Interchangeable Counterbore set. • For a wide range of counterboring, countersinking and spot-facing operations this adds up to great economy and efficiency. Expensive delays due to lack of proper tools are greatly reduced.

Yes, 281 different tools can be made from Counterbore Set C-13 shown below. All parts can be quickly replaced from stock. Complete in wooden case with hinged cover $232.20.

Six other sets are available ranging from $45.90, both in Morse Taper and straight shank type. For full description and prices write today for our Counterbore Bulletin.

The Gairing Tool Company, Detroit, 32, Michigan.

GAIRING

Manufacturers of Standard [illegible] Lock Inserted Blade Cutting Tools

the Statler; the American Welding Society will have headquarters at the Hotel Cleveland; the American Industrial Radium and X-Ray Society will

G. R. FITTERER
Campbell Memorial Lecturer

be located at the Hotel Hollenden, and the Society for Experimental Stress Analysis sessions will be held at the Carter Hotel.

In addition to the regular sessions of the National Metal Congress, the American Society for Metals will pre-

HERBERT J. FRENCH
Past President, ASM, and Recipient of President's Medal

sent a series of practical panel-type afternoon and evening meetings on production problems of immediate and future interest to the metal industry.

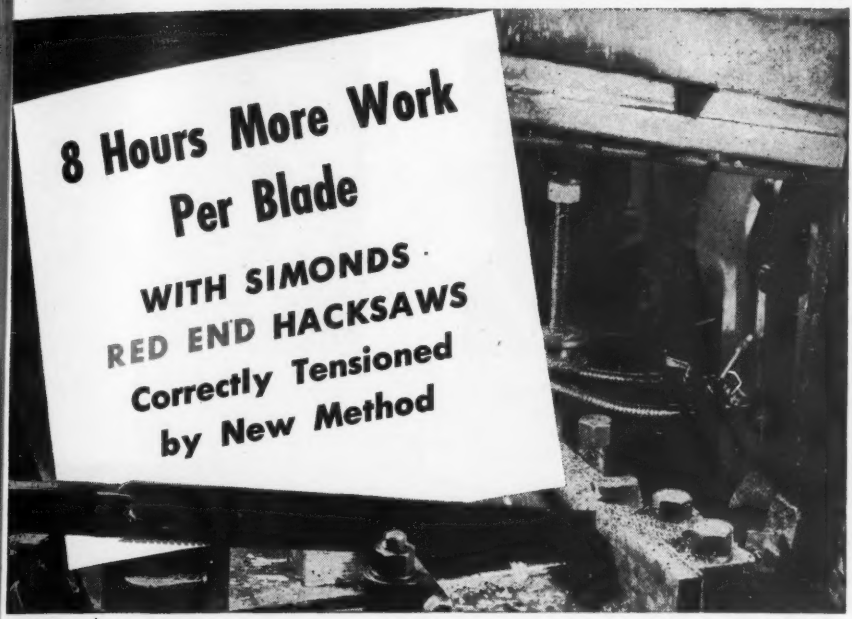
Subjects that have been listed for specific discussion during the five days of sessions include: metal powders and products, metals for railroads, metallurgical furnaces, induction heating, heat treatment, manufacture of quality steels, national emergency steels, surface peening, foundry metallurgy, salt baths, sub-zero treatments, surface finishes and protection, new de-

WALTER E. JOMINY
Recipient of Albert Sauveur Achievement Award

velopments in the study of corrosion, application of quality control instruments, metal cutting and tool materials and lightweight construction.

At the annual dinnner of the American Society for Metals, to be held at the Hotel Statler on Thursday evening, October 19th, the Society will be awarded the Ordnance Distinguished Service Award in recognition of its contributions to the war effort through metals education and training work.

One of the outstanding contributions of the Society was the organization of scores of special advisory committees of metal executives and engineers to work with war materials manufacturers. The services of these consulting committees were free to producers of ordnance equipment and material.



In cutting stainless steel bars, one plant could get only about 9 hours from a hacksaw blade ... and many cuts were concaved because of incorrect blade-tension. Then a *Red End* Blade was put in the same machine ... *correctly tensioned by Simonds' new technique* ... and delivered 17 hours of straight, smooth cutting, *almost double the former blade-life.*

You can get comparable results on *your own* power hacksawing operations. Have your Industrial Supply Distributor bring a Simonds engineer to demonstrate this new tensioning technique right on your own machines. Get in touch *now* with your distributor, or with the nearest Simonds branch office.

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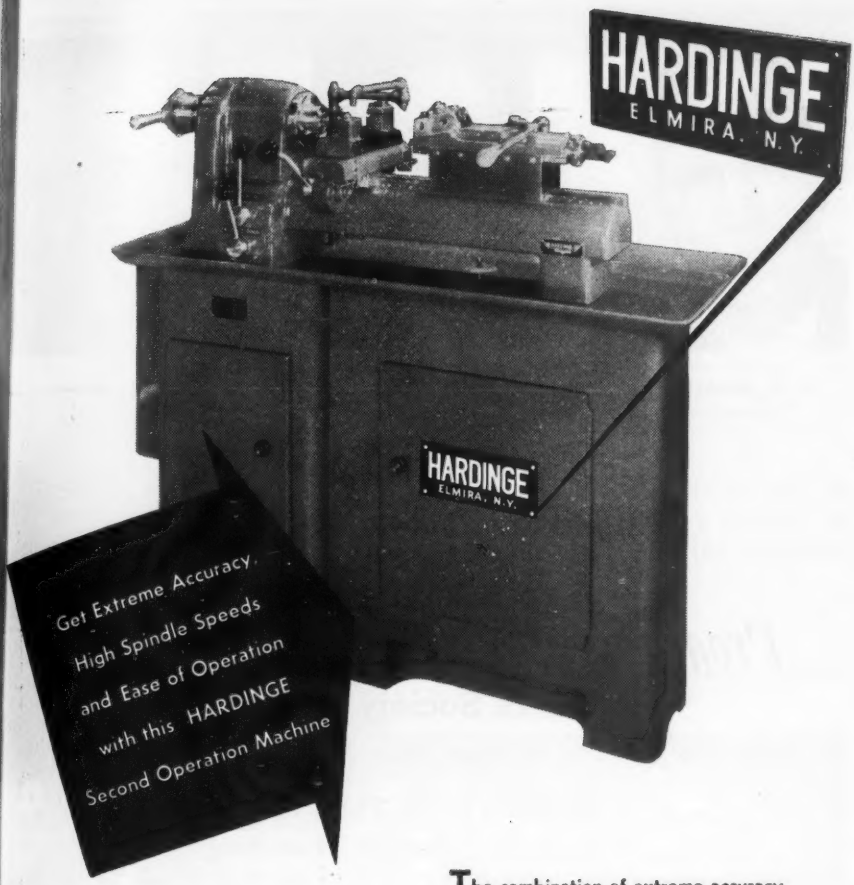

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1/16" to 1" with collets
1" to 6" with step chucks
1" to 5" with jaw chucks
Spindle Speeds
100 to 4000 r.p.m

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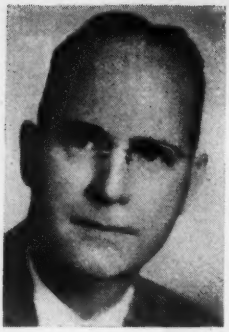
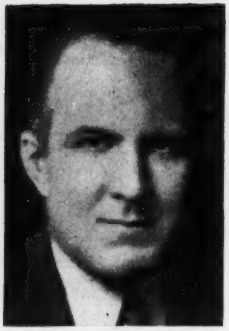


R. W. SCHLUMPFF
Trustee-Elect



DR. KENT R. VAN HORN
President-Elect

L. S. BERGEN
Trustee-Elect

Officers and Trustees-Elect, American Society for Metals

Programs of the Technical Societies

American Society for Metals

(See also Schedule of Panel Discussion Meetings, Page 180)

MONDAY, OCTOBER 16

9:30 A. M.—Surface Hardening

Practical Aspects of the Selection of Frequency and Time Cycles for the Processing of Metallic Parts with Induction Heating, by W. E. Benninghoff and H. B. Osborn, Jr., Ohio Crankshaft Co.

Induction Hardening of Plain Carbon Steels, by D. L. Martin and F. E. Willey, General Electric Co.

Shot for Metal Peening, by O. E. Harder and J. T. Gow, Battelle Memorial Institute.

9:30 A. M.—Hardenability

Rates of Tempering in Cobalt Steels, by E. A. Loria, Carnegie-Illinois Steel Corp.

Isothermal Transformation and End-Quench Hardenability of Some NE Steels, by R. L. Rickett, J. G. Cutton, C. B. Bernhart, Jr., and J. R. Millikin, United States Steel Corp.

Further Developments of the End-Quenched Hardenability Test, by C. R. Wilkes, Earnshaw Cook and Howard S. Avery, American Brake Shoe Co.

A Hardenability Test for Low Carbon and Shallow Hardening Steels, by O. W. McMullan, Youngstown Sheet & Tube Co.

9:30 A. M.—Non-Ferrous Metal

A Survey of Wrought Magnesium Alloy Fabrication, by J. V. Winkler, Dow Chemical Co.

The Copper-Manganese Equilibrium System, by R. S. Dean, J. R. Long, T. R. Graham, E. V. Potter and E. T. Hayes, Bureau of Mines.

Properties of Transitional Structure in Copper-Manganese Alloys, by R. S. Dean, E. V. Potter and J. R. Long, Bureau of Mines.

Age Hardening Copper-Manganese-Nickel Alloys, by R. S. Dean, J. R. Long, T. R. Graham and C. W. Matthews, Bureau of Mines.

11:30 A. M.—Victory Session

Ballroom, Hotel Statler

TUESDAY, OCTOBER 17

9:30 A. M.—Physical Properties

The Mechanism of Failure of 18 Cr, 8 Ni Cracking Still Tubes, by C. L. Clark, Timken Roller Bearing Co., and J. W. Freeman, University of Michigan.

Capillarity of Metallic Surfaces, by E. R. Parker, University of California, and R. Smoluchowski, General Electric Co.

The Effect of Fiber on Notched Bar Tensile Strength Properties of a Heat Treated Low Alloy Steel, by G. Sachs, J. D. Lubahn, L. J. Ebert and E. L. Aul, Case School of Applied Science.

The Effects of Notches of Varying Depth on the Strength of Heat Treated Low Alloy Steels, by G. Sachs, J. D. Lubahn and L. J. Ebert, Case School of Applied Science.

9:30 A. M.—Hardenability

The Effect of Carbon Content on Hardenability, by E. S. Rowland, J. Welchner, R. G. Hill and J. J. Russ, Timken Roller Bearing Co.

Air-Hardenability of Steels, by C. B. Post, M. C. Fetzer and W. H. Fenstermacher, Carpenter Steel Co.

The Partition of Molybdenum in Steel and Its Relation to Hardenability, by Fred E. Bowman, Climax Molybdenum Co.

The Rate of Diffusion of Molybdenum in Austenite and in Ferrite, by John L. Ham, Climax Molybdenum Co.

9:30 A. M.—Aluminum and Magnesium Alloys

New Developments in High Strength Aluminum Alloy Products, by E. H. Dix, Jr., Aluminum Company of America.

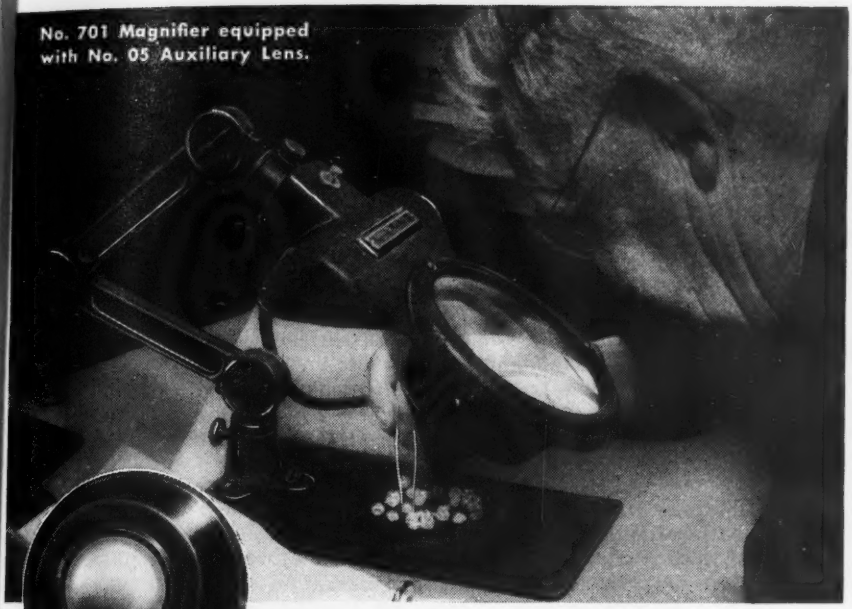
Aluminum Alloy Forging Materials and Design, by L. W. Davis, Aluminum Company of America.

The Properties of Aluminum Alloys Melted in an Induction Heated Crucible Furnace, by James W. Poynter, Army Air Forces, Wright Field.

Magnesium Sheet, by P. T. Stroup and G. F. Sager, Aluminum Company of America, and J. B. West, American Magnesium Corp.

11:30 A. M.—Victory Session

Ballroom, Hotel Statler



No. 701 Magnifier equipped with No. 05 Auxiliary Lens.

No. 05

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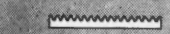
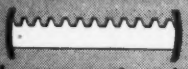
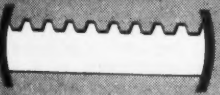


Milled rack as it appears to the unaided eye.



The same rack under the "Flud-Lite" Magnifier's 5-inch lens.



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STANLEY

TRADE MARK

WEDNESDAY, OCTOBER 18

7:30 A. M.—Chapter Chairmen's Breakfast

9:30 A. M.—Annual Meeting of the American Society for Metals

Ballroom, Hotel Statler

Edward de Mille Campbell Memorial Lecture, by G. R. Fitterer, Professor and Head, Department of Metallurgical Engineering, University of Pittsburgh

12:00 M.—Canadian Luncheon

THURSDAY, OCTOBER 19

9:30 A. M.—Melting and Special Alloys

A Comparison of Aluminum and Titanium Deoxidation for Preventing Strain Aging Embrittlement in Low Carbon Steel, by G. F. Comstock and J. [illegible] Lewis, Titanium Alloy Manufacturing Co.

The Ar' Reaction in Some Iron-Cobalt Tungsten Alloys and the Same Modified With Chromium, by W. P. Sykes, General Electric Co.

The Basic Electric Melting Procedure for High Quality Alloy Steels, by A. [illegible] Ascik, Sorel Industries, Limited.

9:30 A. M.—Tool Steel

The Dimensional Stability of Steel—Part I—Sub-atmospheric Transformation of Retained Austenite, by S. G. Fletcher and Morris Cohen, Massachusetts Institute of Technology.

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IN civilian life Chuck worked hard for your Industrial Supply Distributor ◆ Perhaps you didn't know it then—but many a time it was his hard, persistent scouting for scarce materials and supplies that helped you to keep your production going.

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A Study of Subzero Treatments Applied to Molybdenum-Tungsten High Spe Steel, by R. G. Kennedy, Jr., Cleveland Twist Drill Co.

Experiments of Sodium Cyaniding of High Speed Steel Prior to Hardening, John McIntyre, International Business Machine Co.

9:30 A. M.—Radiography and Testing

A Comparison of Microhardness Indentation Tests, by Douglas R. Tate, N tional Bureau of Standards.

Improved Sensitivity in Double Exposure Radiography, by James Rigbey, Fo Motor Company of Canada.

The Interpretation of Radiographs: Particularly of Aircraft Parts, by Les W. Ball, Triplett & Barton, Inc.

11:30 A. M.—Victory Session; 12 M.—College Alumni Luncheo

7:00 P. M.—Annual Dinner of the American Society for Metal

Ballroom, Hotel Statler

FRIDAY, OCTOBER 20

9:30 A. M.—Chromium and Molybdenum Alloys

Chromium Steels of Low Carbon Content, by Russell Franks, Union Carbi and Carbon Research Labs.

Characteristics and Properties of Some Cast Chromium-Molybdenum Stee by N. A. Ziegler and W. L. Meinhart, Crane Co.

The Segregation of Molybdenum in Phosphorus Bearing Alloyed Gray Cast Iro by F. B. Rote, Wyman-Gordon Co. and W. P. Wood, University of Michiga

A. S. M. Group Discussion Meetings

All Meetings in Music Hall and Ballroom of Public Auditorium, Cleveland

Monday, Oct. 16	Tuesday, Oct. 17	Wednesday, Oct. 18	Thursday, Oct. 19	Friday, Oct. 20
2:00 P. M.	**2:00 P. M.**	**2:00 P. M.**	**2:00 P. M.**	**2:00 P. M.**
Metal Cutting and Tool Materials	The Hardenability Band as a Basis for Purchase and Use of Steel	Metals for Railroads	Salt Baths	Heat Treatment
2:00 P. M.	**2:00 P. M.**	**2:00 P. M.**	**2:00 P. M.**	**2:00 P. M.**
Light Weight Construction	Magnesium	Metallurgical Furnaces	Aluminum	Foundry Metallurgy
4:00 P. M.	**4:00 P. M.**	**4:00 P. M.**	**4:00 P. M.**	**4:00 P. M.**
Sub-Zero Treatments	Instruments for Quality Control	Products From Metal Powders	Quality Control by Statistical Methods	Instruments for Quality Control
4:00 P. M.	A—Measurement of Linear Dimensions	**4:00 P. M.**		D—Atmosphere and Combustion
Surface Finishes and Protection	**4:00 P. M.**	Instruments for Quality Control		
8:30 P. M.	Surface Peening to Increase Fatigue Resistance	B—Means to Establish Identity		
Induction Heating	**8:30 P. M.**	**8:30 P. M.**		
8:30 P. M.	National Emergency Steels in Use	Instruments for Quality Control		
What's New in the Study of Corrosion	**8:30 P. M.**	C—Detection and Measurement of Internal Defects		
	Tin; Tin Alloys; Tin Coatings	**8:30 P. M.**		
		Manufacture of Quality Steels		

Nationally known experts in the fields encompassed by these meetings will give brief talks on the various subdivisions of each topic. These men will then act as an information panel for open discussion and questions from the audience. Complete program, including subdivisions and names of panel members, will be circulated to those attending the National Metal Congress.

The outstanding performance of Logan Lathes in sustained accuracy and speed results from the exacting care that goes into every detail of construction. In the final inspection, a point-by-point check of the entire machine assures a completed assembly ready for production service. Of equal importance, all individual parts and all sub-assemblies are thoroughly tested as they are manufactured to prevent incorporation in the machine of any part not up to standard. The rigorous checking of parts, sub-assemblies, and the final inspection, strictly control the consistent accuracy and quality characteristics of Logan Lathes. Write for latest catalog describing all models of Logan Lathes.

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A. I. M. E. Metals Divisions

MONDAY, OCTOBER 16

10:30 A. M.—Euclid Room, Hotel Statler

Magnesium

The Relationship Between Magnesium Core Sand Mixtures and the Burning of Magnesium, by O. J. Myers, Wright Aeronautical Co.

Solubility of Manganese in Magnesium, by N. Tiner, Permanente Metals Corp.

2:00 P. M.—Euclid Room, Hotel Statler

Grain Size of Magnesium

Grain Size and Properties of Sand Cast Magnesium, by R. S. Busk and C. W. Phillips, Dow Chemical Co.

Factors Affecting Grain Growth in Germination of Magnesium Alloy Castings, by A. T. Peters, R. S. Busk, and H. E. Elliott, Dow Chemical Co.

Grain Size of Sand Cast Magnesium Alloys, by Oscar Blohm, Hills-McCanna Co.

TUESDAY, OCTOBER 17

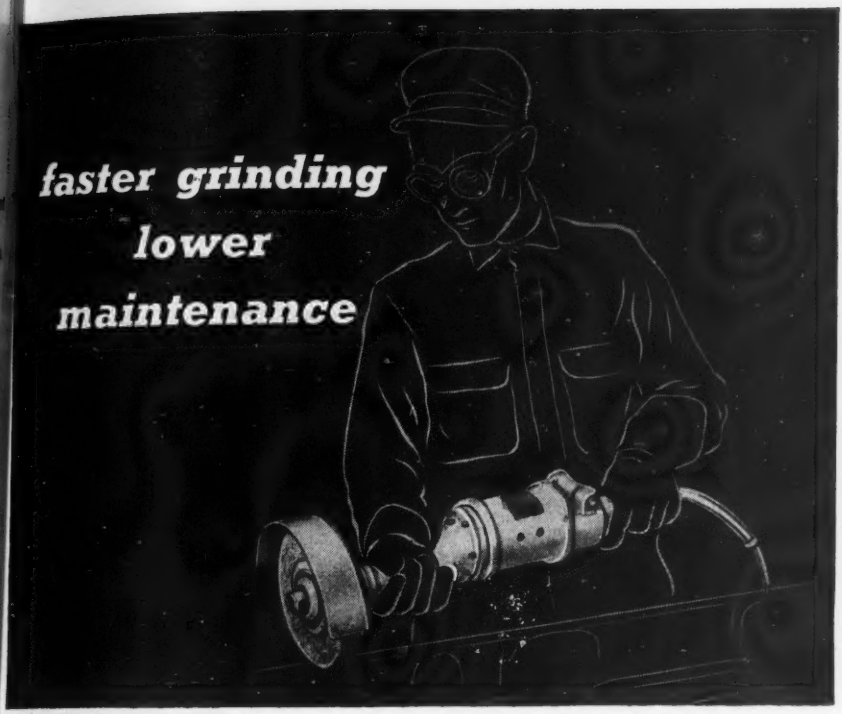
9:30 A. M. and 2:00 P. M.—Euclid Room, Hotel Statler

Symposium on Creep of Non-Ferrous Metals and Alloys

Chairman—M. L. Gurghoff and E. E. Schumacher.

Application of Non-Ferrous Alloys in Stress Design, by J. J. Kanter, Crane Co.

Creep Test Methods and the Interpretation of Creep Data, by P. G. McVetty



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Creep Characteristics of a Phosphorized Copper, by N. L. Burghoff and A. I Blank, Chase Brass and Copper Co.

Creep Properties of Cold Drawn Annealed "B" Monel and Inconel, by B. B Betty, H. L. Eiselstein and P. P. Huston, Jr., International Nickel Co.

Creep Properties of Cast Bronze, by H. E. Montgomery, The Lunkenheimer Co.

Creep Data on Die Cast Zinc Alloy, by E. H. Kelton and B. B. Grissinger, New Jersey Zinc Co.

Creep Properties of Some Rolled Lead Alloys, by A. A. Smith, Jr., American Smelting and Refining Co.

2:00 P. M.—Lattice Room, Hotel Statler

Non-Ferrous Production Metallurgy

Tin Smelting and Metallurgy, by C. L. Mantell, Consulting Chemical Engineer.

Beryllium, by Donald M. Liddell, Consulting Engineer.

Antimony: Its Metallurgy and Refining, by Chung Yu Wang, Wah Chang Trading Corp., and Guy C. Riddell, Consulting Mining Engineer.

WEDNESDAY, OCTOBER 18

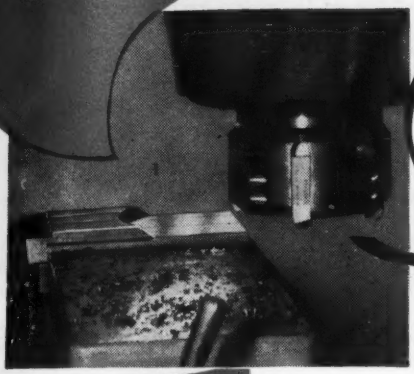
2:00 P. M.—Pine Room, Hotel Statler

General Session

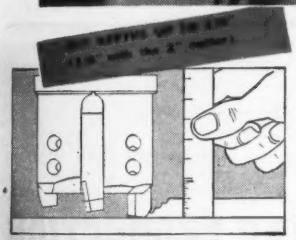
Orientation Structure on the Surface of Cast Metals, by Gerald Edmunds, New Jersey Zinc Co.

KENNAMILL STEP-CUTTERS

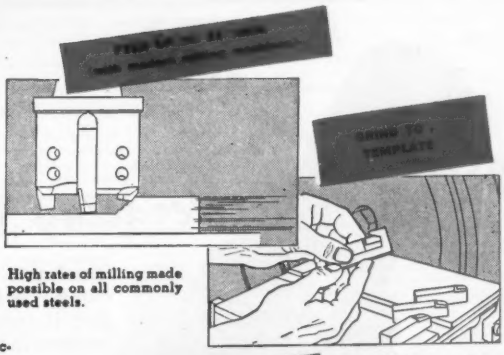
A Simplified Means To Multiply Milling Production with Available Equipment



Kennamills are inserted blade fly-cutters that, in most cases, enable available horsepower to be fully utilized in chip removal.



Desired depth of cut is divided into equal steps.



High rates of milling made possible on all commonly used steels.

Kennamills bring the advantages of high-production carbide milling of steel to every shop that has milling machines of reasonably recent manufacture. They are inexpensive, easy to set-up, and a cinch to maintain. Get in step with modern carbide milling by using this simplified method—write today for catalog information on Kennamills.

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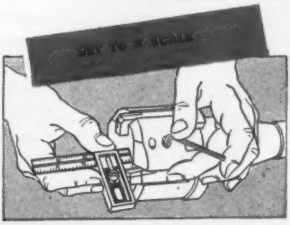
KENNAMETAL Inc. LATROBE, PA.



Blades are resharpened to template on ordinary carbide tool grinder.

Grinding in the head is unnecessary.

The Hardness of Silver-Antimony Solid Solutions, by R. M. Treco and J. H. Frye, Lehigh University.

Substitute Solders on the 85-15 Lead-Tin Type, by James B. Russell, and J. O. Mack, Naval Research Laboratory.

IRON AND STEEL DIVISION

MONDAY, OCTOBER 16

2:00 P. M.—Pine Room, Hotel Statler

General Session

Recovery of Cold Worked Aluminum-Iron as Detected by Changes in Magnetic Properties, by J. S. Stanley, Westinghouse Electric and Mfg. Co.

Distribution of Carbon Between Titanium and Iron in Steels, by W. P. Fishel and Bryson Robertson, Vanderbilt University.

Transformation of Austenite in a 3% Chromium 1% Carbon Steel, by E. P. Klier, Pennsylvania State College.

TUESDAY, OCTOBER 17

10:00 A. M.—Pine Room, Hotel Statler

General Session

Measurement and Control of Hydrogen Embrittlement in Type 440C Stainless Steel Wire, by C. A. Zapffe and M. Eleanor Haslein, Rustless Iron and Steel Corp.

Effect of Time Storage on Ductility of Welded Test Specimens, by C. E. Jackson and G. G. Luther, Naval Research Laboratory.

Because they compress abundant fastening strength into much less fastening space, P-K Socket Screws contribute to a more compact design, and allow substantial metal savings, wherever they can be used.

Look into these savings, and the other design advantages of P-K Socket Screws, while your post-war product is still on the drafting board. Have a P-K Assembly Engineer help you find the spots where they will save assembly time, lower costs, and improve construction.

By specifying Parker-Kalon Socket Screws, you make certain of assemblies that can be trusted for strength and endurance. Unique P-K "Quality-Control" eliminates "doubtful" screws – screws that *look* right, but some of which might fail to *work* right.

PLAN with P-K SOCKET SCREWS –

FOR STRENGTH — Cold-forged of alloy steel, they withstand tremendous stresses. They can be set up tighter — stay tight — smaller sizes can be used. **FOR FASTER ASSEMBLY** — Key never slips — screws hold on end of key for placement in hard to reach spots. **FOR COMPACTNESS** — Less metal required in flanges or other fastening areas. **FOR SAFETY** — No projecting heads on moving parts.

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SOCKET SCREWS

A Product of PARKER-KALON--*Specialists in Fastening Devices*

2:00 P. M.—Pine Room, Hotel Statler

Symposium on Recent Developments in Dilatometric Analysis

Chairmen—F. M. Walters, Jr., and Howard Scott.

Dilatometric Analysis of Sub-atmospheric Transformations, by R. D. Potter, Massachuetts Institute of Technology.

A High-speed Dilatometer and the Transformational Behavior of Six Steels, by A. L. Christiansen, E. C. Nelson, and C. E. Jackson, Naval Research Laboratory.

Precise Expansion Measurements on Non-Ferrous Alloys and Glasses, by W. E. Kingston, Sylvania Electric Products, Inc.

An Interference Type Dilatometer and Some Typical Results, by W. L. Fink and L. A. Willey, Aluminum Co. of America.

WEDNESDAY, OCTOBER 18

2:00 P. M.—Euclid Room, Hotel Statler

Symposium on Steelmaking

Chairmen—L. F. Reinartz and H. K. Work.

Theoretical and Practical Aspects of Deoxidation in Basic Open Hearth Practice, by T. S. Washburn, Inland Steel Co.

Slag-Metal-Oxygen Relationships in the Basic Open Hearth and Electric Processes, by J. S. Marsh, Bethlehem Steel Co.

A Rapid Laboratory Method for Estimating Basicity of Open-Hearth Slag, by W. O. Philbrook, A. J. Jolly, Jr., and T. R. Henry, Wisconsin Steel Works.

It pays to believe in signs—sometimes!

We're mighty proud of the one pictured above. It is not only our stamp of a job well done, but is your assurance of well engineered, well constructed machine tools.

We are currently in production on the following products:

- **UNIVERSAL TOOL GRINDERS**
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- **ABRASIVE WHEEL DRESSERS**
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Literature on any or all products will be gladly sent to you on request.

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ABERDEEN **SOUTH DAKOTA**

Application of pH Slag Basicity Measurements to Basic Open-Hearth Phosphorus Control, by Michael Tenenbaum and C. C. Brown, Inland Steel Co.

9:30 A. M.—Fracture and Grain Size

Fractography—A New Tool for Metallurgical Research, by Carl A. Zapffe and Mason Clogg, Jr., Rustless Iron and Steel Corp.

Cleavage Structures of Iron-Silicon Alloys, by Carl A. Zapffe and Mason Clogg, Jr., Rustless Iron and Steel Corp.

Grain Shape and Grain Growth, by David Harker, General Electric Co., and Earl R. Parker, University of California.

Fracture Studies of Soldered Joints, by F. Berman and R. H. Harrington, General Electric Co.

9:30 A. M.—Rolling and Graphitization

Annealing Studies on Cold-Rolled Iron and Iron Binary Alloys, by C. R. Austin, L. A. Luini and R. W. Lindsay, Pennsylvania State College.

The Effect of Cold Rolling on the Structure of Hadfield Manganese Steel, by Norman P. Goss, Cold Metal Products Co.

Factors Controlling Graphitization of Carbon Steels at Subcritical Temperatures, by C. R. Austin, Pennsylvania State College, and M. C. Fetzer, Carpenter Steel Co.

11:30 A. M.—Victory Session

Ballroom, Hotel Statler

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Reconversion

Look

At Your Bearings

It makes little difference whether your machinery and equipment has been on war duty or inactive service. Before you convert to civilian production check up on the bearings. Breakdowns because of bearing failure can be prevented. When replacement is necessary—specify Johnson UNIVERSAL Bronze. It's the best on the market.

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Society for Experimental Stress Analysis

Annual Fall Meeting, Hotel Statler, October 17, 18, 19 and 20

TUESDAY, OCTOBER 17

10:00 A. M.—Grand Ballroom, Hotel Carter

Words of Welcome by President W. M. Murray

Technical Session

Chairman—C. O. Dohrenwend, Armour Research Foundation.

Shot Peening to Improve Fatigue Resistance, by O. J. Horger and H. R. Neifert, The Timken Roller Bearing Co.

Plastic-Flow Problems by Photo-Grid Methods, by J. F. Harding and C. P. O'Haven, Armour Research Foundation.

Load Distribution in Riveted and Spot-Welded Joints, by M. Goland and L. D. Morris, Curtiss-Wright Corp.

2:30 P. M.—Grand Ballroom, Hotel Carter

Technical Session

Chairman—O. J. Horger, The Timken Roller Bearing Co.

Residual Stress Studies of Life Improving Surface Treatments, by R. W. Greaves, E. C. Kirstowsky and C. Lipson, Chrysler Corp.

New Approaches to Engineering Design, by E. E. Stilson, R. H. Peterson and R. C. Pocock, Bendix Aviation Corp.

WEDNESDAY, OCTOBER 18

10:00 A. M.—Grand Ballroom, Hotel Carter

Symposium on Crankshaft Stresses

Chairman—C. Lipson, Chrysler Corp.

Structural Evolution of a Crankshaft, by S. Oldberg and C. Lipson, Chrysler Corp.

Determination of Operating Loads and Stresses in Crankshafts, by A. Goloff, Caterpillar Tractor Co.

Metallurgical Processing of Packard Built Rolls-Royce Crankshafts, by M. L. Frey, Packard Motor Car Co.

2:30 P. M.—Grand Ballroom, Hotel Carter

Technical Session

Chairman—J. M. Lessells, Massachusetts Institute of Technology.

Full Scale Fatigue Testing of Crankshafts, by C. W. Gadd and N. A. Ochiltree, General Motors Research Laboratories.

Determining Crankshaft Durability for Increased Performance of In-Line Engine, by W. Osborn, Sterling Engine Co.

THURSDAY, OCTOBER 19

10:00 A. M.—Grand Ballroom, Hotel Carter

Technical Session

Chairman—C. W. MacGregor, Massachusetts Institute of Technology.

The Application of Stress Models to Specific Structural Problems, by S. F. Tingley, Goodyear Aircraft Corp.

Electrical Analogy for Shear Lag Problems, by R. E. Newton, Curtiss Wright Corp.

Electric Method for the Solution of Laplace's Equation, by V. Paschkis, Columbia University.

6:30 P. M.—**S.E.S.A. Dinner,** *Grand Ballroom, Hotel Carter*

FRIDAY, OCTOBER 20

10:00 A. M.—Grand Ballroom, Hotel Carter

Technical Session

Chairman—E. L. Shaw, Goodyear Aircraft Corp.

Precision Determination of Weight by Means of Bonded Strain Gages, by A. L. Thurston, Cox & Stevens Aircraft Corp., and R. W. Cushman, The Foxboro Co.

The Magnetic Coupled-Torque Meter, by B. F. Langer, Westinghouse Research Laboratories.

Impact Stress Analysis by Brittle Coatings, by G. Ellis, Magnaflux Corp.

2:30 P. M.—Grand Ballroom, Hotel Carter

Special Session on Electrical Strain Gage Techniques

who dares to talk to them about a

THIRD WORLD WAR?

They were at Tarawa.

Many of them now wear empty sleeves, or bandages where their eyes were. And a thousand and twenty-six will rise up never from the sands of Tarawa Island.

They couldn't hear it. In the roar of that tornado, as they fought and fell, so far from the hills of home, they couldn't hear the words: "... *history repeats ... and what will we get out of it but ... how the hell can we police ... the next one will be against ... already sowing the seeds for ... and twenty years from now, brother ... the Third World War ...*"

In elevators, on the street, in plush chairs that let you down easy, in columns and editorials and from the political stump.

What is the matter with us? Can't we at home at least go into *peace* with some spark of their courage and determination that this war is not another mockery, not just another World War? Let no man give voice to that weak and deadly cynicism. Let him stand up and think straight and have the courage to call the lie to any man in public or private life who fails to do the same.

And let each of us do everything humanly possible to help win this war sooner ... buy War Bonds—give blood—boycott the black market ... and plan ahead now for a *better* America than we had before.

Today, the engineers of the machine tool industry can greatly help the post-war planners of government and business management. One of these is a Bryant man ... We invite you to send for him.

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD, VERMONT, U. S. A.

Chairman—G. S. Burr, Forging Research Association.

Electric Gaging Systems: Their Selection and Application, by H. C. Robert, University of Illinois.

Open Forum for Discussion on Characteristics of Amplifiers, Characteristics of Galvanometers, Calibration Circuits, Methods of Recording, Use of Crystals in Stress Analysis, and Additional Topics Put Forward by the Audience.

American Welding Society

Twenty-Fifth Annual Meeting, Hotel Cleveland, October 16-19

MONDAY, OCTOBER 16

9:30 A. M.—Opening Session

Chairman—David Arnott, President, American Welding Society.

Vice-Chairman—E. V. David, Chairman, Convention Committee.

Presentation of Medals and Prizes.

Welding Aids the War Effort

Welding as an Aid in Shipbuilding Construction, by Admiral H. L. Vickery, U. S. Maritime Commission.

Welding as an Aid in the Fabrication of Ordnance Equipment, by Col. S. B. Ritchie, Office, Chief of Ordnance.

Welding in Aircraft Construction, by W. B. Stout, Consolidated Vultee Aircraft Corporation.

2:00 P. M.—Welding and Cutting in Heavy Industries

Chairman—R. J. Yarrow, Republic Structural Iron Works.
Vice-Chairman—J. M. Driscoll, Air Reduction Sales Co.

Fundamentals of Heavy Cutting, by G. L. Walker and H. G. Hughey, Air Reduction Sales Co.

Steel Mill Maintenance, by E. W. Gruber, Wheeling Steel Corp.

Unusual Applications of Gas Cutting in Ordnance Fabrication, by C. M. Underwood, Northern Ordnance, Inc.

Procedure Control of Automatic Welding Processes, by A. E. Bedell and J. B. Quigley, Graver Tank & Mfg. Co., Inc.

2:00 P. M.—Railroad and Transportation

Chairman—J. W. Sheffer, American Car and Foundry Co.
Vice-Chairman—A. G. Oehler, Railway Age.

Welding of Aluminum Tank Cars, by A. H. Woollen, Railroad Sales, Aluminum Co. of America.

Railroad Welding, by John McMullen, Erie R. R.

2:00 P. M.—Weldability

Chairman—A. B. Kinzel, Union Carbide & Carbon Corp.

Vice-Chairman—C. H. Jennings, Westinghouse Electric & Mfg. Co.

Welding of Manganese Steels, by W. B. Brooks and A. G. Waggoner, Cramp Shipbuilding Co.

High Tensile Manganese-Silicon Steels for Welded Fabrication, by G. G. Luther and F. H. Laxar, Naval Research Lab.

The Bead-Weld Nick-Bend Test for Ductility, by C. E. Jackson and G. G. Luther, Naval Research Lab.

The Influence of Minor Variables of Weldability, by R. D. Stout, S. S. Tor and G. E. Doan, Lehigh University.

8:00 P. M.—Adams' Lecture

Chairman—Wendell F. Hess, Rensselaer Polytechnic Institute.

Vice-Chairman—R. H. Aborn, United States Steel Corp.

Solid Phase Welding, by A. B. Kinzel, Union Carbide & Carbon Corp.

TUESDAY, OCTOBER 17

9:30 A. M.—Resistance Welding

Chairman—L. C. Bibber, Carnegie-Illinois Steel Corp.

Vice-Chairman—G. N. Sieger, S. M. S. Corp.

Spot Welding Machines for Heavy Gauges of Ferrous and Non-Ferrous Metals, by Mario Sciaky, Sciaky Bros.

Heat Transfer Across Contact Surfaces, by W. B. Kouwenhoven, Dean, School of Engineering, Johns Hopkins University.

Problems in Spot Welding Heavy Mild Steel Plate, by F. R. Hensel, E. I. Larsen and E. F. Holt, P. R. Mallory & Co., Inc.

9:30 A. M.—Research

Chairman—S. L. Hoyt, Battelle Memorial Institute.

Vice-Chairman—R. E. Kinkead, Consulting Welding Engineer.

The Effect of Postheating in Welding Medium Alloy Steels, by M. A. Pugacz and G. J. Siegel, Naval Research Laboratory.

Stress Relieving Study, by Prof. J. R. Stitt, Ohio State University.

The Effects of Metallurgical Changes Due to Heat Treatment Upon the Fatigue Strength of Carbon-Steel Plates, by W. H. Bruckner, and W. H. Munse, University of Illinois.

9:30 A. M.—Structural

Chairman—A. S. Low, The Austin Co.

Vice-Chairman—J. F. Maine, Republic Structural Iron Works.

Standard Details for Welded Building Construction, by H. W. Lawson, Bethlehem Steel Co.

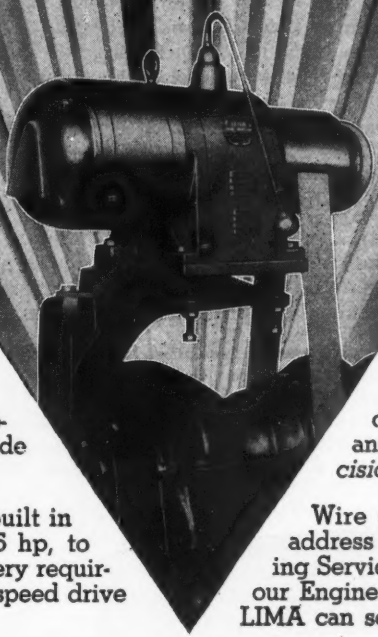
Field Welded Pressure and Variable Volume Storage Tanks, by Fred L. Plummer, Hammond Iron Works.

2:00 P. M.—Resistance Welding

Chairman—R. E. Powell, Western Electric Co.

Vice-Chairman—H. C. Cogan, National Electric Welding Machines Co.

MOTØRIZE *with* LIMA DRIVES



For unit motorization of Machine Tools, you can select no better drive equipment than that made by LIMA.

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Low Reactance Cable for Portable Resistance Welders, by Myron Zucker, Mack worth G. Rees, Inc.

The Flash Welding of Alloy Steels—Welding Techniques and Variables, by J. J. Riley; **Metallurgical and Physical Characteristics,** by J. C. Barrett, Taylor-Winfield Corp.

Small Portable Condenser Welding Set, by E. M. Callender, E. G. Budd Mfg. Co.

2:00 P. M.—Research

Chairman—H. C. Boardman, Chicago Bridge & Iron Co.
Vice-Chairman—G. V. Slottman, Air Reduction Sales Co.

Some Recent Developments in Stainless Steel Welding, by D. L. Mathias, Metal & Thermit Corp.

Bi-axial Fatigue Strength of Low-Carbon Steels, by George K. Morikawa and LeVan Griffis, Illinois Institute of Technology.

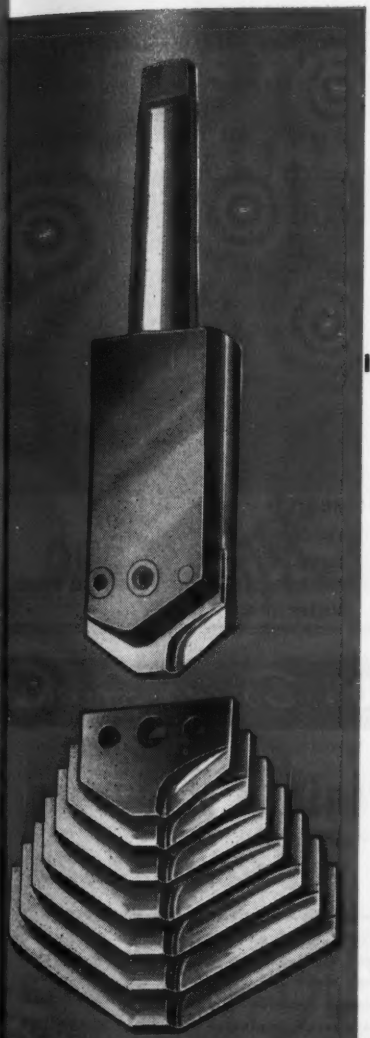
Intergranular Corrosion of Stainless Steel Welds, by Wm. T. Tiffin, University of Oklahoma.

Weldability Tests of Cast Steel, by C. E. Jackson and F. S. McKenna, Naval Research Lab.

2:00 P. M.—Ships

Chairman—J. L. Wilson, American Bureau of Shipping.
Vice-Chairman—S. A. Midnight, American Shipbuilding Co.

Controls Required for Sale and Economical Construction of Welded Ships, by D. G. Maxson, Welding Consultant, Marinship Corp.



Showing how various standard size CONNER drill tips are interchangeable and accommodated in constant length holder.

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A MULTI-TIP DRILL!

CUTS YOUR DRILL INVESTMENT Over **90%** **IN INVENTORY AND STORAGE SPACE**

Here's the new advance—the new development for larger sized drills you've been waiting for—the **Conner Multi-Tip Drill.** Comes in standard taper-shank holders. Standard drill tips are furnished to drill from the solid. Each holder will accommodate several interchangeable drill tips (standard size). These tips are made of hardened high-speed steel in steps of 1/16". Special holders and special sizes also available, permitting many extensions.

For special applications, one design permits oil under pressure to be flushed directly on the cutting edge of the drill tips by having an oil hole through the shank and forking out to each lip of the drill. Then there are extensions for deep hole drilling with cross slots on the end which fit the rectangular section of the holder—thus taking all the strain off the tang. Any type or size shank can be furnished, straight for fitting directly in turrets, or tapers for spindles.

Write for literature and prices. Learn at what an unbelievable low cost you can be fully equipped for every drilling need.

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Please send me literature on MULTI-TIP DRILLS.

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Technical Control of Welding in Ship Construction, by M. H. MacKusick, California Shipbuilding Corp.

Evolution of Welding in Shipbuilding, by M. N. Maltseff, Western Pipe and Steel Co.

Multiple and Stack Machine Cutting, by A. H. Yoch, Air Reduction Sales Co.

8:00 P. M.—University Research Conference

WEDNESDAY, OCTOBER 18

9:30 A. M.—Aircraft

Chairman—G. S. Mikhalapov, National Research Council.
Vice-Chairman—C. W. Dodge, Sciaky Bros.

Impact Strength of Arc Welded Joints in Aircraft Steel, by H. O. Klinke, Republic Aviation Corp.

Helium Shielded Arc Welding of Exhaust Collector Rings, by Francis R. Stevenson, Lockheed Aircraft Corp.

Multi-Arc Welding of Aluminum Alloys, by M. R. Rivenburgh and C. W. Stewart, Curtiss-Wright Corp.

9:30 A. M.—Research

Chairman—Isaac Harter, The Babcock & Wilcox Co.
Vice-Chairman—E. R. Seabloom, Crane Co.

Weldability—as-Rolled vs. Heat-Treated High Strength Constructional Steels, by Lt. S. A. Herres and W. L. Warner, Watertown Arsenal.

The Effect of Time and Temperature on the Relief of Residual Stresses in Low Alloy Steels, by J. K. McDowell and Paul C. Cunnick, Lt. Col., Ordnance Dept., Rock Island Arsenal.

Development and Application of Modern Heavy Coated Arc Welding Electrodes, by D. C. Smith and W. G. Rinehart, Harnischfeger Corp.

2:00 P. M.—Aircraft

Chairman—G. O. Hoglund, Aluminum Co. of America.

Vice-Chairman—E. S. Jenkins, Curtiss-Wright Research Laboratory.

The Geometry of a Spot Welding Tip and Its Relation to Tip Life, by E. D. Crawford and C. W. Steward, Curtiss-Wright Corp.

Survey of Chemical Cleaning Practices for Spot Welding Aluminum Alloys, by F. M. Morris, Kaiser Cargo, Inc., Fleetwings Div.

An Evaluation of Process Control of Aircraft Welding, by P. H. Merriman, The Glenn L. Martin Co.

Characteristics of Welding Arcs on Aluminum in Atmospheres of Helium and Argon, by F. A. Wassell, General Electric Co.

2:00 P. M.—Machinery

Chairman—A. E. Gibson, Wellman Engineering Co.

Vice-Chairman—R. J. Kriz, The James H. Herron Co.

Production Problems and Production Control, by E. C. Brekelbaum, Harnischfeger Corp.

Routine Inspection and Salvage of Machinery Weldments—Rough, Partial

ack of every Lake Shore ool are the facilities and trilled personnel of one America's most completely equipped plants.

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Machined and Machined, by James W. Owens, Fairbanks, Morse & Co.
Welded Jigs and Fixtures, by A. N. Kugler, Air Reduction Sales Co.
Design of Welded Machinery, by John Mikulak, Electric Machinery Manufacturing Co.

2:00 P. M.—Piping and Pressure Vessels

Chairman—A. C. Weigel, Combustion Engineering Co.
Vice-Chairman—R. W. Emerson, Pittsburgh Piping & Equipment Co.
Pressure Vessel Welding, by Edward B. McGuire, Hamler Boiler & Tank Co.
Normalizing of Welds in Carbon-Molybdenum Pipe by 60-Cycle Induction Heating, by I. A. Rohrig and D. H. Corey, The Detroit Edison Co.
Properties of Welded Joints Between Dissimilar Metals, by E. C. Chapman and R. E. Lorentz, Combustion Engineering Co.
Oxy-Acetylene Pressure Welding, by A. R. Lytle, Union Carbide & Carbon Res. Labs.

6:30 P. M.—Section Officers Dinner and Conference

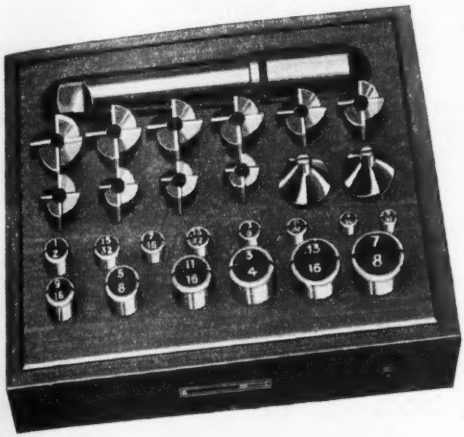
THURSDAY, OCTOBER 19

9:30 A. M.—Foundry

Chairman—L. A. Danse, Cadillac Motor Car Div.
Vice-Chairman—Austen J. Smith, The Lunkenheimer Co.
Arc Welding Practices in the Steel Foundry, by Frank Kiper and Lawrence Gabes, Ohio Steel Foundry.

MIDWEST COUNTERBORE SETS

—FOR COUNTERBORING AND SPOT FACING OPERATIONS THAT SAVE THE TIME AND COST OF EXTRA SET-UPS, OTHER SLOWER MACHINING AND COMPLICATED ASSEMBLIES



Set No. 1 Contains The Following Items:

One #5MB Group Holder
One #7MB Group Holder

COUNTERBORES

3/16" Dia.	3/8" Dia.
5/16" "	13/16" "
11/16" "	1" "
3/4" "	1 1/16" "
13/16" "	1 1/8" "

COUNTERSINKS

3/8" Dia.	60 Deg.
7/8" "	82 "

PILOTS

5/16" Dia.,	1/4" Shank
3/4" "	1/4" "
7/16" "	1/4" "
1/2" "	1/4" "

PILOTS

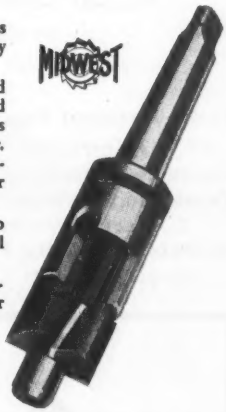
3/16" Dia.,	1/4" Shank
5/16" "	1/4" "
11/16" "	1/4" "
3/8" Dia.,	5/16" Shank
7/16" "	5/16" "
1/2" "	5/16" "
9/16" "	5/16" "
5/8" "	5/16" "
11/16" "	5/16" "
3/4" "	5/16" "
13/16" "	5/16" "
7/8" "	5/16" "
15/16" "	5/16" "
1" "	5/16" "

Midwest Counterbore Sets include only standard tools; replacements can be made promptly from our stock. The cutters can be reground quickly and easily; and reground many times before replacement is necessary.

Each set is furnished with a corresponding range of alloy steel, hardened and ground pilots. Pilots are chamfered at front end and they are designed for quick interchanging or removing in case of breakage. Each set is furnished with Group Holders fitted with *Midwest Taper and Pin Drive.* There is perfect alignment between the holder and cutter—highly important in an assembled tool. Each holder handles a wide variety of cutter sizes. Cutters can be interchanged in a jiffy.

You can depend upon Midwest Precision Quality and Manufacture to provide faster cutting operations, sustained accuracy and economical performance.

Midwest also makes special combination counterbores, step counterbores for two or more diameters, holders with stop collars and other production-type combinations.



Cutaway View Showing Features of Midwest Counterbore Assembly.

Midwest offers a complete designing and engineering service. Send us an outline of any metal cutting problems you may have and let us send you suggestions on the way to solve them with a minimum of tools and operations.

Consult the Midwest Representative located nearest to you. He is thoroughly experienced and can ably assist you.

Midwest Precision Metal Cutting Tools are also handled by many leading Industrial Distributors.

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Machine Cutting of Risers, Flame Scarfing to Remove Padding, and Flame Gouging to Remove Webs and Defects, by G. E. Bellew, Air Reduction Sales Co.

Repair of Castings, by L. A. Danse, Chairman, G. M. Metallurgical Committee, General Motors Corp.

9:30 A. M.—Miscellaneous

Chairman—W. E. Crawford, A. O. Smith Corp.
Vice-Chairman—A. L. Pfeil, Universal Power Corp.

Low Temperature Joining, by W. D. Wasserman and C. E. Swift, Eutectic Welding Alloys Co.

A Method for Measuring the Bond Strength of Sprayed Metal Coatings, by Kenneth Wilson, Metallizing Engineering Co.

How Much Ductility Is Necessary for Structure or Machine?, by W. J. Conley, Lincoln Electric Co.

2:00 P. M.—Business Meeting

3:00 P. M.—Board of Directors Meeting

American Industrial Radium and X-Ray Society, Inc.

Annual Convention, Hollenden Hotel. October 19 and 20

THURSDAY, OCTOBER 19

Morning—Technical Session

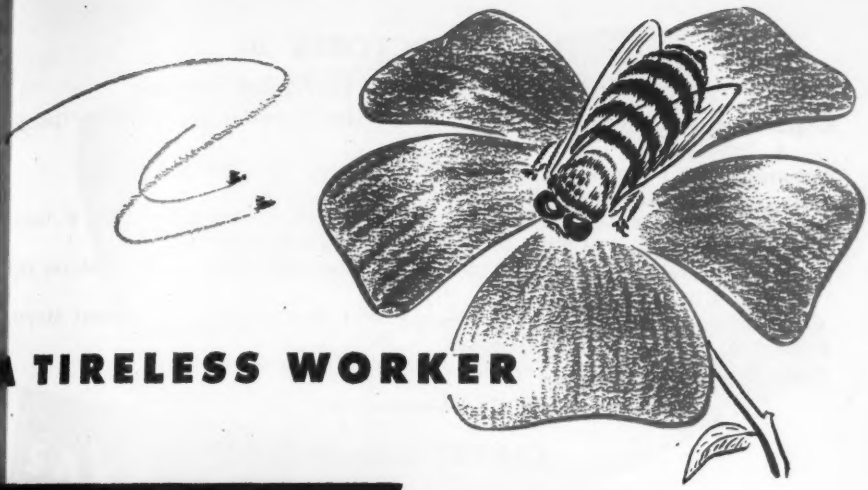
Three Technical Papers; Titles to Be Announced.

Afternoon—Annual Meeting and 1944 Mehl Lecture

Election of Officers.

Experimental Stress Analysis in Radiographically Sound Materials, by George L. Clark, University of Illinois.

Address by Retiring President, Maynard B. Evans, Jr., Ternstedt Mfg. Division, General Motors Corp.



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FRIDAY, OCTOBER 20

Morning and Afternoon—Technical Sessions

Requirements in Specifications for Uniform Radiographic Technique, by Geo A. Russ.

Automatic Film Processing and Equipment, by Robert Sarderson.

X-Ray and Welding Control, by John J. Chyle.

Quality Control of Radiographs by a Direct Density Check, by Alvin F. Co

A Simplified Method of Film Evaluation, by Emery Meschter.

Method of Determining Metal Thickness Radiographically, by H. P. Moyer a P. L. Kline.

A Practical Comparison of Fluoroscopy with Radiography, by Robert Ma

Filtration, by Don M. McCutcheon.

Three Dimensional Radiography, by Douglas Wineck.

CLEVELAND SECTION

American Industrial Radium and X-Ray Society

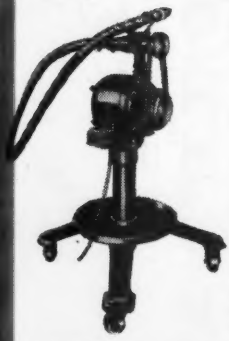
Monday Evening, October 16

Hotel Hollenden

Use of Microradiography in Identifying Defects in Castings, by L. W. B Triplett & Barton Corp.

SAVE *Critical* TIME!

H-6



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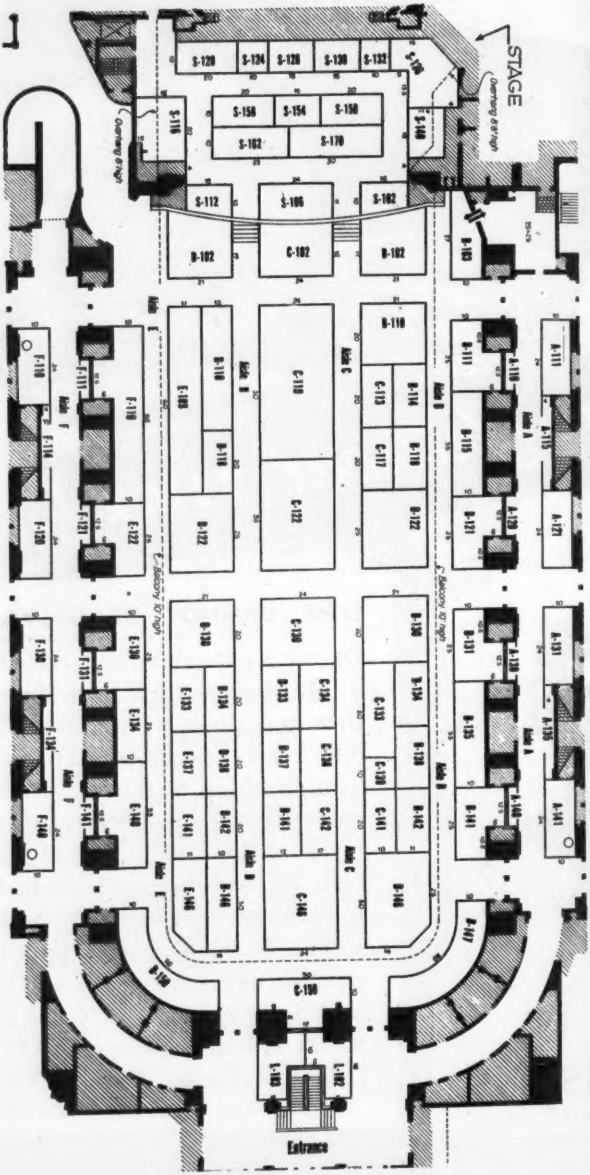

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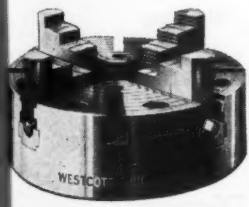

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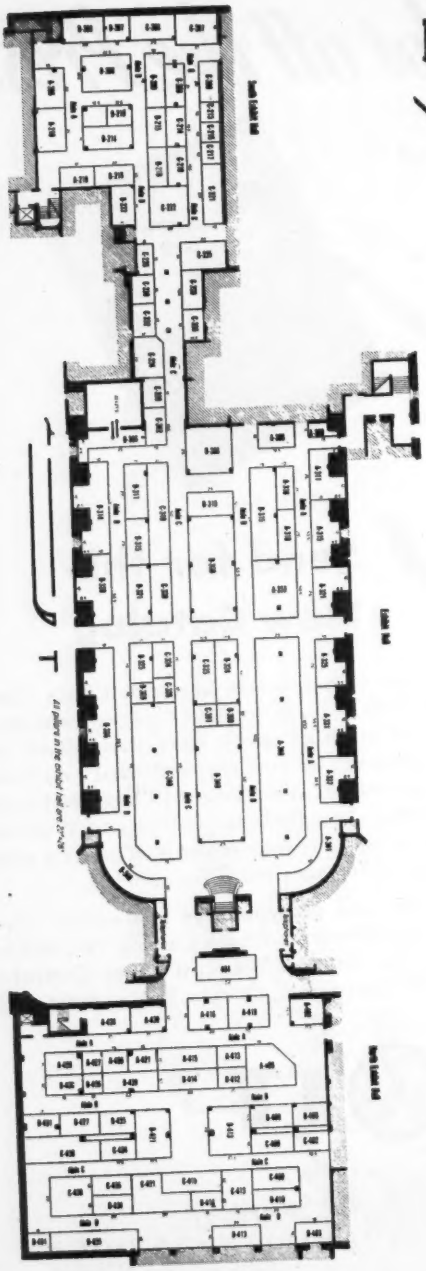


Arcade

Floor Plan

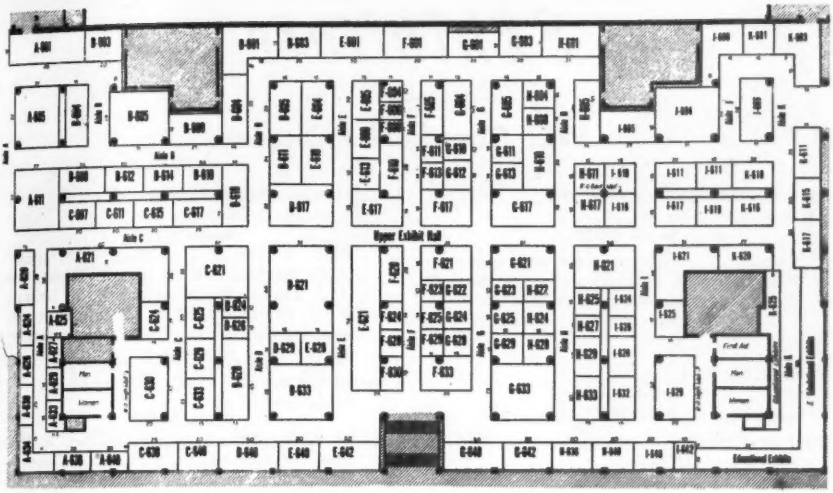
Showing

Arrangement of War Conference Displays

at

Cleveland Public Auditorium

UPPER EXHIBIT HALL



THE Cleveland Public Auditorium, in which the War Conference Displays are to be presented, is divided into five sections, as follows: the Arena, the Upper Exhibition Hall, Lower Exhibit Hall, Arcade, and Lakeside Exhibit Hall. The Arena, with which the stage is included, is on the street level. The other four exhibit halls are on the lower level, reached by stairs from the Arena.

The entrance is from Lakeside Avenue and leads through the foyer into the Arena. Just inside the hall is a huge stairway leading to the lower level. Underneath the Arena is the section known as the Upper Exhibition Hall, while in the opposite direction is the Lower Exhibit Hall, the Arcade and the Lakeside Exhibit Hall.

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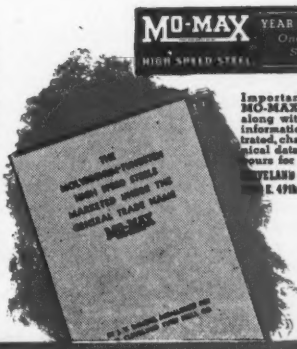

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Muenz, New York Representative; W.
Leech, advertising manager.

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sales manager; H. P. Rice, Chicago r
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Booth A-315

BRIGGS MANUFACTURING CO.
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ing; P. J. Meifert, purchasing agen
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War has taught Industry many things. Not the least of these is how to use carbides to cut all kinds of metals and cut them faster and at lower cost.
That's a good point to remember when you pull out your pre-war prints to start tooling up again to build autos, trucks and refrigerators.
When you do, call on our field engineers to help you re-convert "forward" instead of "backwards". TCT has been designing carbide tools "to the job" since 1928—when carbides were first produced in this country.
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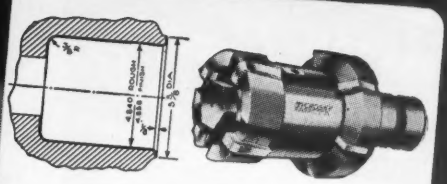
Produces standard and special tools that are strong and rugged...yet easily adjusted, reground, rebladed



Multiple Operation Tool for Facing, Chamfering, and Boring Hole with Radius in Bottom

The shape, simplicity and small size of McCrosky's Jack-Lock Wedge makes it particularly suited for mounting multiple blades in small space.

When tightened — see view above — the screw bears against the bottom of the recess—raising the wedge—*like a jack*—locking the blade rigidly in the tool body. With the Jack-Lock—multiple blade tools attain the strength and rigidity of solid tools—yet release of the blades for adjustment, regrinding or replacement is quick and easy.

Specify McCrosky—leader for 40 years—for "standard," or "special" inserted blade tools that do 3, 4, 5 or even more operations *at the same time,* increasing production, and cutting costs.

Catalog 16-M describes McCrosky standard Jack-Lock Tools

Catalog 17 describes McCrosky Multiple operation "Special" Jack-Lock Tools.

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DI-ACRO BENDERS

DI-ACRO precision bending is accurate to .001" for duplicated parts. DI-ACRO Benders bend angle, channel, rod, tubing, wire, moulding, strip stock, etc. Machines are easily adjustable for simple, compound and reverse bends of varying radii.

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showing many kinds of DIE-LESS DUPLICATING" produced with DI-ACRO Benders, Brakes and Shears.

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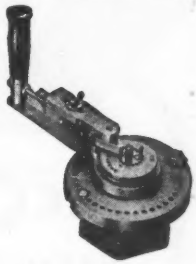
The DI-ACRO Bender makes perfectly centered eyes from rod or strip stock at a high rate of production. Both eye and centering bend are formed with one operation. Any size eye may be formed within capacity of bender and ductile limits of material.



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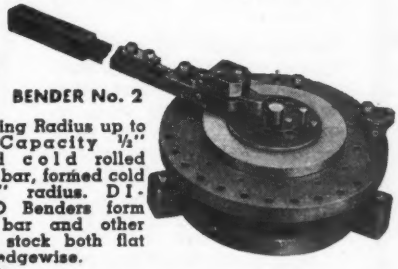

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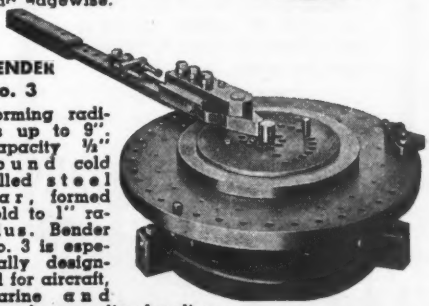

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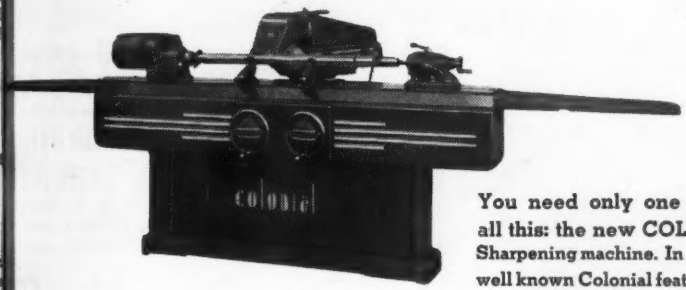

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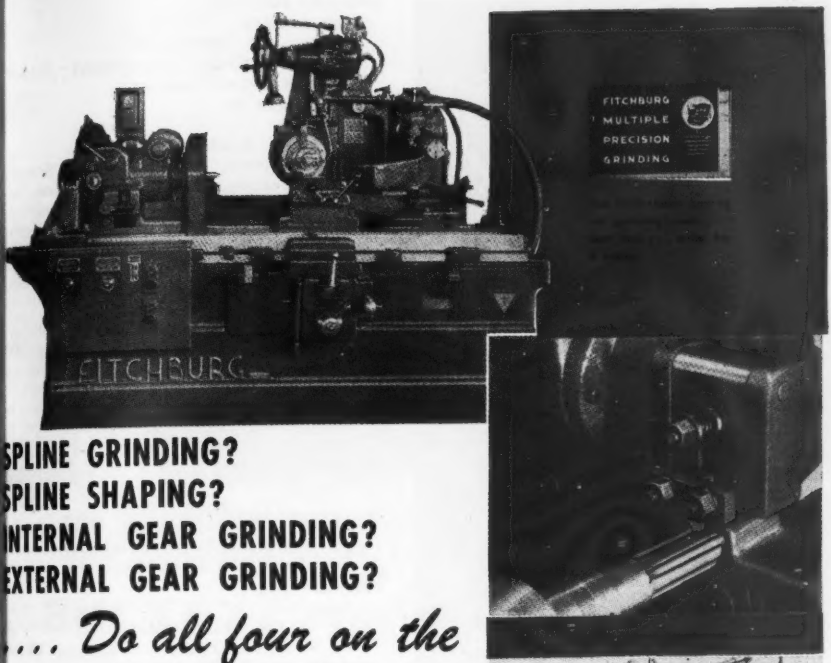

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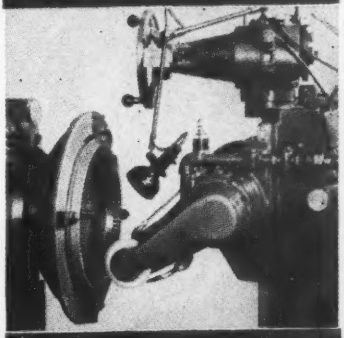

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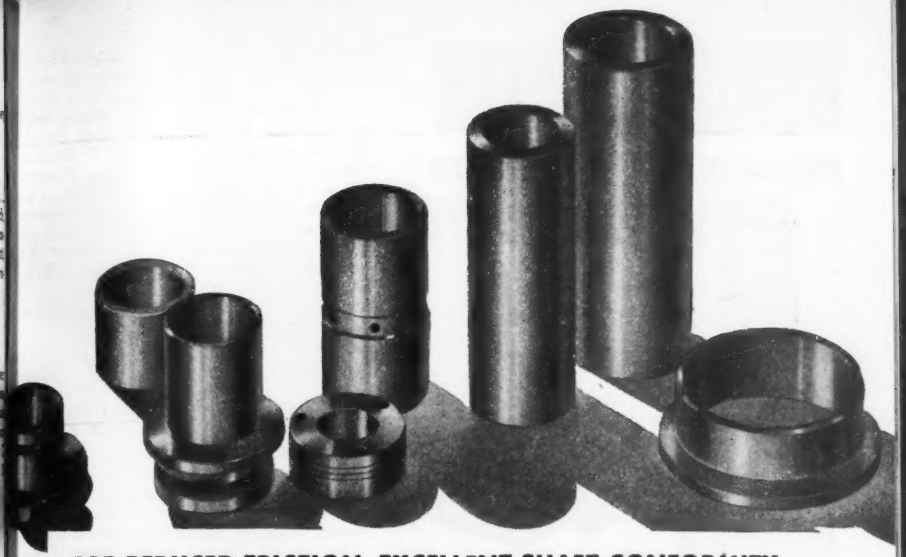

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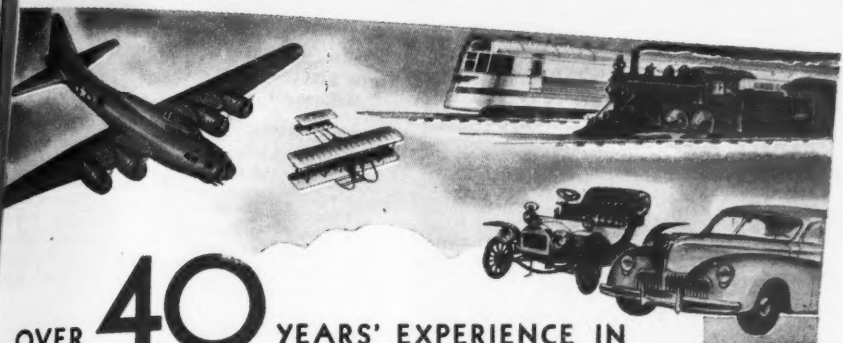

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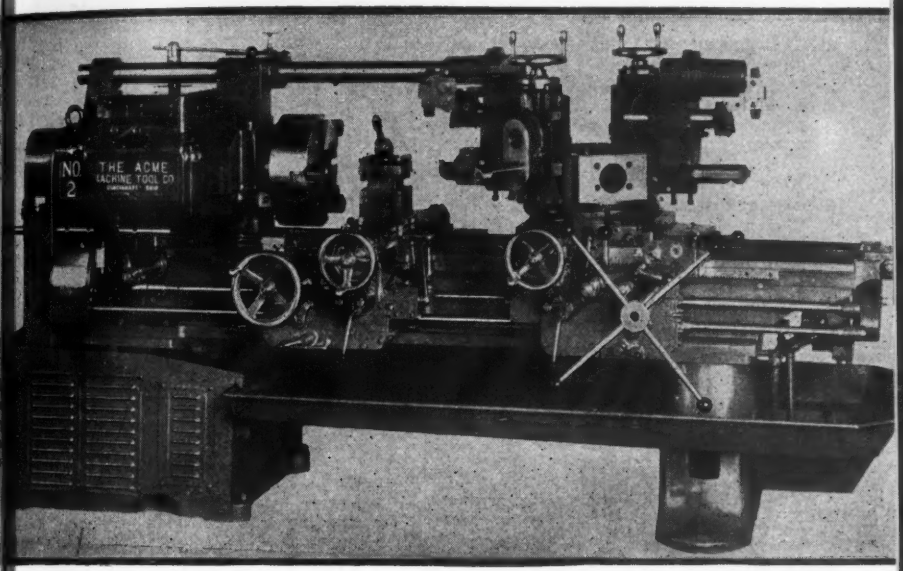

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Head and bed are combined into one rigid, well braced casting — cross ribbed the entire length to carry great loads without vibration.

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Marthinson, and W. Hall Marshall, repr
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It meets the four major requirements for aircraft welding service:

1. Ability to strike and maintain an arc easily over the entire range of welding on light gauge work.
2. Easy stepless welding current adjustment.
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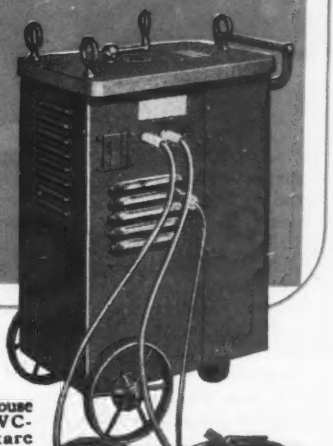
4. High efficiency and power factor.

This new welder eliminates need for "adapting" welders intended for other types of service with their slower and less flexible performance. Superimposed high frequency makes the a-c arc practical on light materials at low currents and boosts welding output.

For more information, write Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa.

J-70413-B



Westinghouse model WC-AC Flexarc Welder—high-frequency stabilized—175 amperes (10-200 amperes).

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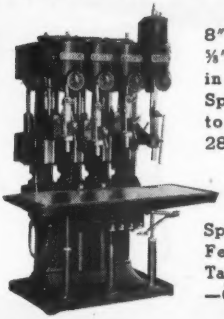

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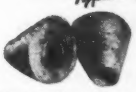

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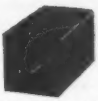

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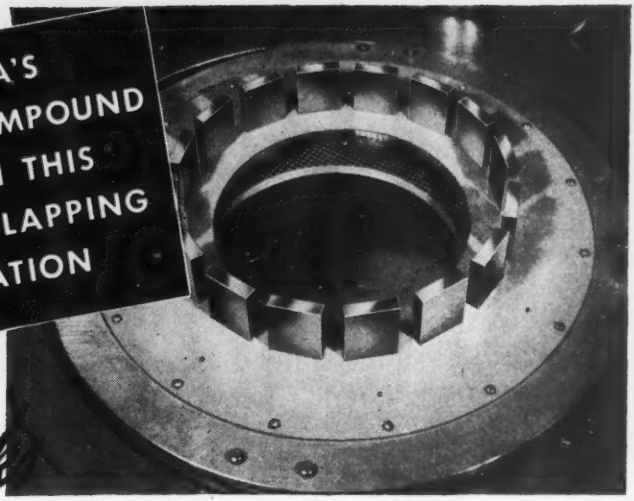

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29

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Los Angeles
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LUKENWELD, INC.
Booth B-110

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Coatesville, Pa.
Booth B-110
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(Lukens Steel Co.): George A. Cardwell, manager of alloys; Everett C. Gosnell, chemical engineer; Herbert A. Ottey, manager of flanging sales; Dr. William G. Theisinger, director of welding research.
(By-Products Steel Corp.): Harry H. Meyer, manager of sales; Marvin C. Moffett, products engineer.
(Lukenweld, Inc.): Robert C. Sahlin, manager of sales; Edward J. Charlton, assistant to the president.

MAAS AND WALDSTEIN CO.
Newark, N. J.
Booth C-209

MACHINE DESIGN
Booth E-146

MACHINE TOOL BLUE BOOK
Booth B-629

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Los Angeles
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MAGNAFLUX CORP.
Chicago
Booth E-621
A. V. deForest, chairman, board of [illegible]

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METAL INDUSTRIES CATALOG
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METAL PROGRESS
Cleveland
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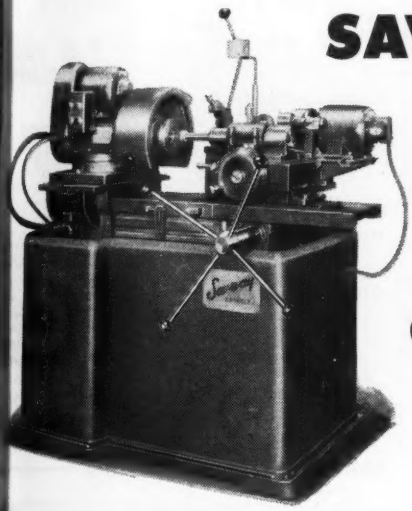

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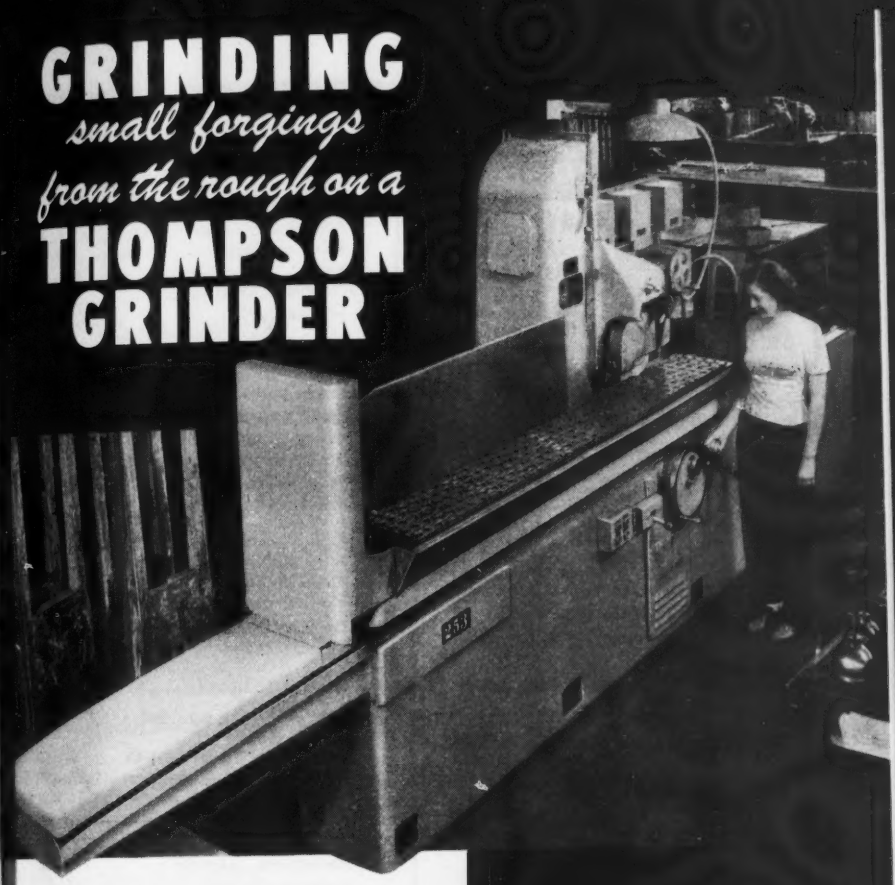

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REVISTA INDUSTRIAL
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Booth B-330
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SELAS CORP. OF AMERICA
Philadelphia
Booth D-122

Frederic O. Hess, president; James Kniveton, engineering consultant; J. A. Ehlinger, chief engineer, furnace division; Fred Maud, chief engineer, automatic machinery division; Carl P. Mann, manager, drying division; A. A. Furczyk, chief development engineer; James B. Henwood, development engineer; Paul F. Berg, development engineer; Carl R. Berger, Jr., metallurgical engineer; G. V. Jordan, Jr., scientific equipment division.

SENTRY COMPANY
Foxboro, Mass.
Booth C-324

Gordon Wheeler, sales manager; Murray Winter, president; P. B. Crocker, general manager; G. B. Duff, district manager, Newark, N. J.; G. S. Ewing, sales engineer, Newark; B. M. Brownell, district manager, St. Louis; C. W. Rudolph, district manager, Chicago; D. R. Grandy, district manager, Cleveland; T. R. Nickles, sales engineer, Cleveland; C. R. Pollock, district manager, Detroit.

SHAKEPROOF, INC.
Chicago
Booth C-310

SHELDON & CO., E. M.
Muskegon, Mich.
Booth J-611

E. J. Sheridan, vice-president and sales manager; R. E. Worick, R. B. Morrison, M. Maxwell, and L. W. Smack, salesmen.

SHELL OIL COMPANY, INC.
New York City
Booth J-604

E. L. Bastian, C. E. Brown, and W. Day, head office lubricants technical representatives.

SHERMAN & CO.
New York City
Booth F-621

Monroe Sherman; Samuel Shaw, sales engineer; Dorothy Livingston, Nu-Brass

SIZE CONTROL CO.
Chicago
Booth C-213

SLY MANUFACTURING CO., W. W.
Cleveland

Booth A-306

R. W. Helmig, production manager; R. O. Mullen, assistant sales manager; L. R. Brewster, Cleveland sales engineer; E. M. Faflick, sales engineer; F. E. Wolf, Detroit sales engineer; Arthur H. Bond, Western New York sales engineer.

SMITH TOOL & ENGINEERING CO.
Bucyrus, Ohio

Booth I-616

K. C. Jenney, sales manager; S. K. Kalber, engineer.

SOCIETY OF EXPERIMENTAL STRESS ANALYSIS
Cambridge, Mass.

Booth C-215

C. Lipson, Chrysler Corp., in charge.

SPARKLER MFG. CO.
Mundelein, Ill.

Booth I-626

A. C. Kracklauer, general manager and partner; Wm. J. Kracklauer, sales manager and partner; H. Corrodi, Ohio sales and service engineer; J. C. Lally, Pennsylvania sales and service engineer.

SPENCER TURBINE CO.
Hartford, Conn.

Booth B-118

F. A. Wright, special representative; C. S. Gardiner, R. B. Richardson, and G. I. Houliston, sales representatives; R. A. Brackett, sales manager.

SPERRY PRODUCTS, INC.
Hoboken, N. J.

Booth B-414

STANDARD ALLOY CO.
Cleveland

Booth D-410

H. M. Smith, president; P. G. Lutz, vice-president; F. P. Morrow, sales manager; C. B. Jackson, field superintendent; R. D. Forsyth, Detroit representative; K. J. Reardon, Chicago representative; L. W. Heap, steel mill representative.

STANDARD OIL CO. (OHIO)
Cleveland

Booth B-609

M. R. Bower, industrial sales manager; C. W. Rupert, H. W. Johnston, J. H. Allison, G. H. Black, F. R. Need, E. G. Gott, G. C. Svatos, W. H. Foster, G. S. King, M. S. Obenauf, J. A. Lindsay, E. C. Binder, S. H. Davis, K. M. Howell, C. B. Sears, D. S. Bruggeman, J. H. Wieland, J. Adams, H. Gillett, J. Baadte, H. A. Hamiston.

STANDARD STEEL SPRING CO.
Coraopolis, Pa.

Booth S-170

R. C. Enos, president; M. B. Hammond, vice-president; C. J. Queenan, vice-president; L. C. Conradi, chief metallurgist; W. R. Munger, sales; Don McGee, advertising.

G. B. Bowman, chemist; Franklin Stockton, chemist; J. A. McConaughy, engineer; Damon C. Antel, engineer; J. J. Rohror, mechanical engineer; Clyde Cupps, development engineer.

STATE MANUFACTURING & CONSTRUCTION CO.
Franklin, Ohio

Booth G-625

Edward A. Mayer, partner; Leo M. Ward, partner; George E. Boullain, chief engineer; Wilbur J. Wright, Cleveland area engineer.

STEEL PUBLICATIONS, INC.
Pittsburgh

Booth H-620

STEEL

Booth D-414

Don N. Watkins, president; N. R. Moll, executive vice-president; H. Milton Reich, vice-president in charge of sales; Charles Longenecker, vice-president in charge of editorial; W. N. Robinson, editor; F. B. Yeager, field representative; T. B. Little, eastern representative.

STERLING ALLOYS, INC.
Woburn, Mass.

Booth B-115

G. C. McCormick, president; W. R. Blair, vice-president; H. I. Dixon, sales manager; R. B. Steele, New York City field engineer; T. J. Donovan, Jr., Philadelphia; P. Otto, Springfield, Mass.; W. G. Merowit, Buffalo; J. N. Berger, Pittsburgh; A. F. Tenn... Dayton; C. C. Miller, Detroit; C. L. Robe... son, Indianapolis; E. W. Bock, Milwaukee; R. Garfield, Cleveland; H. Steffens, C... cago.

STEVENS GREASE AND OIL CO.
Cleveland

Booth I-610

C. W. Beck, vice-president; A. Roy A... son, manager, Crystal division; W. N. D... muth; sales engineer; R. I. Patterson, sa... engineer; A. L. Gressel, chemist.

STOW MANUFACTURING CO.
Binghamton, N. Y.

Booth I-629

J. P. Dickinson, vice-president in char... of sales, in charge of exhibit.

STRONG, CARLISLE & HAMMOND CO.
Cleveland

Booth C-234

STUART OIL CO., LIMITED, D. A.
Chicago

Booth B-324

William H. Oldacre, president and gene... manager; F. J. Schmitt, sales manager; E. McCoy, assistant to sales manager; A. Erickson, engineer; J. I. Carr, advertising manager; C. H. Baker, W. F. Aub... P. Tomlinson, O. M. Gibson, H. W. Schi... F. W. Smith, J. L. Morosini, F. W. Sta...

J. Rodnite, J. Y. Umbarger, C. M. Ho... Jr., C. J. Nagel, E. J. Graham, P. Silv... G. F. Stanford, W. H. Huelster, and ... Gratton, representatives.

STURGIS PRODUCTS CO.
Sturgis, Mich.
Booth H-621
L. R. Davidson, president; D. T. Bo... secretary-treasurer; F. L. Grim, chem...

SUNNEN PRODUCTS CO.
St. Louis
Booth C-402

SURFACE COMBUSTION
Toledo, Ohio
Booth B-608
Frank H. Adams, vice-president and ... eral manager; C. B. Phillips, vice-pres... in charge of sales; H. M. Heyn, sales ... ager in charge of heat treat divisio... H. Koch, in charge of standard indus... equipment; J. M. Brown and H. T. Go... sales engineers, Cleveland; C. W. C... and E. G. Buschow, Pittsburgh; W. ... Herdrich and Edw. Stephenson, Jr., De... W. O. Owen, H. J. Gregg, and G. J. ... genderfer, Chicago; H. O. Bennett, A... son; W. J. Murray, Syracuse; A. C. ... sole, advertising.

SUTTON ENGINEERING CO.
Pittsburgh and Bellefonte, Pa.
Booth A-640
J. B. Sutton, president; Ann C. Penny, ... retary; O. J. Skawden, chief engineer.

SWAN-FINCH OIL CORP.
New York City
Booth I-621

TAGLIABUE MFG. CO., C. J.
Brooklyn, N. Y.
Booth C-408

TAL'S PRESTAL BENDER, INC.
Milwaukee
Booth B-403
Art B. Doyle, production manager; ... Tal, president.

TEL-AUTOGRAPH CORP.
New York City
Booth C-238
J. B. Carlyon, sales manager; S. S. ... son, Chicago district manager; Alice ... ore Drew, advertising manager; A... Fava, assistant to president; H. C. Ge... Cincinnati branch manager; Wi... Hayes, Pittsburgh branch manager; C... Huber, Detroit branch manager; H. A. ... rence, Cleveland branch manager.

TEMPIL CORP.
New York City
Booth C-117
Robert J. Pass, general manager; Ho... M. Ward, production manager; Ge...

Wolten, research director.

TENNANT CO., G. H.
Minneapolis
Booth S-112
Orville C. Hognander, sales promotion manager; W. L. Wiegman, John Hugh Kelley, and Robert H. Baldwin, district managers.

TEXAS COMPANY
New York City
Booth B-425
F. M. Pobst, chief engineer, Indianapolis district; W. C. Lockwood, technical division, New York; J. P. Dryer, C. M. Wescott, and F. D. Corcoran, cutting oil engineers, Chicago district; H. E. Nicholson and M. S. Oldham, cutting oil engineers, Indianapolis district; F. C. Kerns, superintendent, lubricating sales, New York; N. H. Steindler, chief engineer, Chicago district.

TINNERMAN PRODUCTS CO.
Cleveland
Booth I-617
G. A. Tinnerman, Wm. M. Buttriss, Carl Kasper, C. L. Judd, T. O. Dahlstrand, R. A. Hartman, R. Smith, J. Kurt.

TORIT MFG. CO.
Booth A-620

TOWMOTOR CORP.
Cleveland
Booth F-605
C. E. Smith, vice-president and sales manager; E. R. Wallace, district sales representative; W. L. Utley, assistant to sales manager; A. I. McClelland, sales department; John F. Anderson, assistant sales promotion manager; Dan Wessman, service manager; Edward Southworth, sales promotion manager.

TRENT CO., HAROLD E.
Philadelphia
Booth I-611
Harold E. Trent, president; E. F. Ewing, sales manager; O. N. Jones and H. Martin, Cleveland; R. E. Brown and F. Fisch, Pittsburgh; Geo. R. Horne and C. Oberhauser, Detroit; M. J. Cleary and C. J. Sampson, St. Louis; Roy M. Nelson, Chicago; Stanley L. Currier, Cincinnati; Wm. G. Merowit, Buffalo; D. C. Gettis, R. H. McOuat, and D. P. Williams, Florida.

TRENT TUBE MFG. CO.
East Troy, Wis.
Booth B-203
F. E. Elge, W. Nickels.

TRI-COLOR MACHINE CO.
Kenosha, Wis.
Booth B-203

TROY STAINLESS STEEL PRODUCTS CO.
East Troy, Wis.
Booth B-203

TYLER CO., W. S.
Cleveland
Booths C-413 and D-412
M. S. Brandt, H. E. Brown, S. M. Gra
C. A. Jenks, and C. F. Miller, Clevela
P. W. Combs, Detroit; J. H. Holstein a
N. C. Ruggie, Chicago; D. V. Vigneu
Philadelphia; John Haig, New York C
Ned Menzies, Seattle; C. A. Schiring, B
ton; A. D. Busch, St. Louis; E. M. Graha
San Francisco; R. A. Dorner, St. Cath
ines, Ont.

UDYLITE CORP.
Detroit
Booths D-628 and D-632
L. V. Nagle, vice-president; J. V. Dar
chief engineer, Wm. Young.

ULTRA LAP MACHINE CO.
Detroit
Booth D-604
N. Walker, president; B. C. White, vi
president; H. W. Muellenhagen, servi
manager.

UNION STEEL PRODUCTS CO.
Albion, Mich.
Booth P-526
C. T. Hatch, vice-president and chief en
neer; P. C. Ewbank, plant manager; C.
Brunner, plant engineer; I. P. Nelson, ea
ern district sales manager; R. H. De
western district sales manager; R.
Swartwout, manager, industrial handli
sales, in charge of exhibit.

UNITED CHROMIUM, INC.
New York—Detroit—Waterbury
Booth H-629
H. D. McLeese, sales manager; T.
Coyle, technical director; L. A. Cit
field, R. J. Wooley, C. H. Eldridge, R.
Dudley, E. N. Riotte.

UNITED STATES HOFFMAN MACHINERY CORP.
New York City
Booth A-636
E. R. Clark, manager, filtration divisi
F. J. Armstrong, chief engineer, filtra
division; and C. A. Wallace, C. I. Walle
A. J. Sanders, J. C. Besler, G. C. Bea
W. G. Parry, R. W. Strickland, and J.
Schwarzer, filtration division; C. Ri
Lee, Jr., sales manager.

UNITED STATES STONEWARE CO.
Akron, Ohio
Booth H-640
J. M. W. Chamberlain, president; H.
Farkas, vice-president and sales manag
Ray W. Grace, assistant sales manager
F. Siddall, director of research; Larry
bel, J. S. McKenzie, and Paul Strahl, sa

UNIVERSAL-CYCLOPS STEEL CORP.
Bridgeville and Titusville, Pa.
Booth G-605

J. O. Rinek, vice-president; Frank Garratt, vice-president and technical director; C. T. Evans, vice-president; W. J. Long, assistant general sales manager; N. I. Stotz, assistant general manager—Cyclops Division; H. E. Replogle; Rugus W. Snyder, metallurgist; H. O. Schultz, metallurgist; C. T. Evans, Jr., metallurgist; O. Zmeskal, research metallurgist; H. R. Reese, Cleveland district sales manager; Wilson Kinsey, Cincinnati district sales manager; B. A. Weed, Cleveland sales.

UPTON ELECTRIC FURNACE DIVISION
Commerce Pattern Foundry & Machine Co.
Detroit
Booth I-625

E. J. Rousseau, president; Richard C. Upton; E. E. Cloutier, comptroller; Ernest J. Elliott, sales manager; R. C. Stewart, Canadian district representative; Frank K. Zeigler, Chicago representative; Roy E. Lyn Buffalo representative; Lombard Smith California representative.

VASCOLOY-RAMET CORP.
Booth P-522

VAN DER HORST CORP. OF AMERICA
Cleveland
Booth C-425

George H. Lieser, sales engineer; Wayne M. Carleton, market planning manager.

WASHINGTON, STATE OF
Seattle, Wash.
Booth D-603

WAYNE FOUNDRY CO.
Detroit
Booth H-608

WELDING ENGINEER PUBLISHING CO.
Chicago
Booth D-329

G. H. Mackenzie, president; T. B. Jefferson, editor; C. B. Clason, associate editor; D. I. Watson, midwest advertising representative; T. E. Depew, eastern advertising representative; R. L. Simon, promotion manager.

WELLMAN CO., S. K.
Cleveland
Booth D-150

S. K. Wellman, president; J. R. Nurney, executive vice-president; W. E. Canfield, vice-president in charge of sales; C. D. Heiser, director of public relations; T. J. Novotney, laboratory manager; Don Coleman, assistant sales manager; W. E. Weiss, Cleveland branch manager; H. L. Kinney, manager, industrial department; E. N. Brownell, manager, machine tool department; R. B. Aufmuth, N. M. Lawler,

F. J. Lowey, S. E. Truesdell, engineers.

WELLS MANUFACTURING CORP.
Three Rivers, Mich.
Booth D-611
A. E. Armstrong, president; W. F. Wells, vice-president; F. R. Judd, secretary-treasurer; R. W. Bowers, general manager; J. E. Worline, purchasing agent; V. L. Beckle, sales assistant; Eugene VanLoo, Jr., service engineer; Rex Orr, factory service; M. H. Worline F. B. Hagenbuch, George Wells, and A. H. Turnbull, field engineers.

WIEGAND CO., EDWIN L.
Pittsburgh
Booth E-605

WILLSON PRODUCTS, INC.
Reading, Pa.
Booth G-613
S. C. Herbine, sales manager, industr... district division; W. D. Gross, and C. ... Harrison, industrial distributors' divisi...

WRIGHT-HIBBARD INDUSTRIAL ELECTRIC TR... CO., INC.
Phelps, N. Y.
Booth B-206

WESTERN METALS
Los Angeles
Booth A-632
Jay Jenkins, publisher; L. V. Hohl, ... manager; David Carmen, midwest ma... ger.

WESTINGHOUSE ELECTRIC & MANUFACTUR... COMPANY
East Pittsburgh, Pa.
Booth B-340
J. B. Seastone, manager, feeder engine... ing; W. A. Graham, feeder engineer; ... J. H. Germany, manager, heating sect... L. H. Gillette, J. F. Baker, and C. E. Be... heating section; L. M. Gumm, manag... steel mill and metal working section; C. ... Stainback, manager, industrial departm... John Hoop, generating engineer; C. S. E... son, manager, X-ray application dept.

WHALLEY CO., GEORGE
Cleveland
Booth C-229
George Whalley, president; Victor ... Whalley, vice-president; Vernon Verh... warehouse manager; Julia Csokmay, s... retary.

WHEELCO INSTRUMENTS CO.
Chicago
Booth C-138
R. A. Schoenfeld, vice-president and g... eral manager; T. A. Cohen, vice-presid... and director of research; Chas. L. Sa... ders, vice-president and eastern manag... A. H. Kruger, application engineer; J. ... Freyberg, public relations; Clarke J... Cleveland district manager; C. L. Cl... Detroit district manager; Earl E. Whitc... Pittsburgh district manager; W. L. W...

lingford, Cincinnati manager; M. H. Wilson, Toronto manager; M. K. Whiting, Cleveland sales and service; W. J. Olson, Buffalo manager; C. W. Lugar, Indianapolis district manager.

WILLIAMS AND COMPANY, INC.
Cleveland
Booth B-431
J. H. Penske, Jr., district manager; D. J. Connelly, A. B. Kibby, H. F. Roberts, R. C. Harrison, G. J. Schmidt, R. C. Whitney.

WILSON MECHANICAL INSTRUMENT CO., INC.
New York City
Booth C-134
V. E. Lysaght, sales manager; J. B. Verrier, assistant sales manager; C. H. Thompson, Ohio-Pennsylvania representative; C. W. Smith, Michigan representative; Paul Fee, Illinois representative; J. L. Kavalaris, Indiana representative; Floyd Olin, Western New York representative; S. P. Rockwell Co., New England representative; Canadian-Fairbanks Morse Co., Ltd., Canadian representative.

WOOD PRODUCTS CORP., J. R.
New York City
Booth B-218
Rawson L. Wood, president; Arthur W. Muller, assistant production manager.

YALE & TOWNE MFG. CO.
Booth A-409

YERGES MFG. CO.
Booth F-633

ZAGAR TOOL, INC.
Cleveland
Booth E-628
Walter Zagar, president; Frank Zagar, vice-president; Leslie Korody, sales manager; Edward F. Dain, Cleveland representative; C. A. Reece, advertising manager.

150-Seater Aeroplane

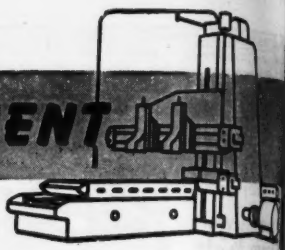
A luxury air liner intended to carry 15[illegible] passengers from New York to Londo[illegible] non-stop was shown recently in mock[illegible] form at Consolidated-Vultee aircra[illegible] plant, Texas. The aircraft, which is not to be built until after the war, will carry sufficient fuel reserves to reach alternative airfields in Europe in the event of bad weather.

Known as the Consolidated 37, it has a wing span of over 200 ft., two decks levels, and will be able to make three round trips a week.

Without luxury accommodation it could carry 400 passengers.

Anglo-American Ne[illegible]

NEW SHOP EQUIPMENT



Colonial Model CS2 Broach Sharpener

The illustration herewith shows the Model CS2 Broach Sharpener now being offered by the Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich. Especially designed for easy operation by women workers, the machine can be used in sharpening round and flat broaches—spline, serrated, and other types—up to 7 feet long and up to 6 inches in diameter and 8 inches in width respectively.

Of particular importance in making broach sharpening easy is the light-weight alloy construction of the sliding head which is supported on and guided by full anti-friction double-row roller bearings that are completely sealed against entry of grinding dust to ensure maintenance of ease of action of the head for the life of the machine.

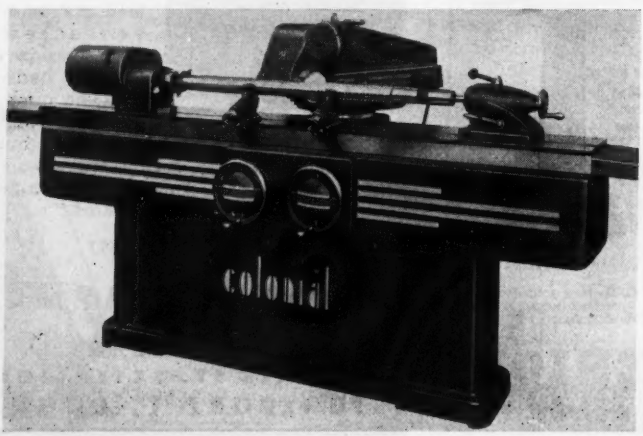
Available on special order is an arrangement which makes possible the maintaining of identical steps per tooth in regrinding broaches. This arrangement comprises the use of Colonial dual-ratio micrometer handwheels with whic feed can be controlled to ten thou sandths of an inch.

Also available on order is a specia roller curtain design for protecting th ways of the machine when the table i moved to one side or the other. O the standard machine, metal guards ar provided for this purpose. The rolle curtain design permits a reduction of feet in total floor space required whe sharpening broaches of maximum lengt that can be handled on the machine.

Change-over from sharpening roun to flat broaches can be accomplishe quickly and conveniently without specia tools and with few adjustments. Uni versal positioning and movement of th grinding wheel are obtained by the u of a vertical column, a cross slid mounted on graduated support, and graduated wheel head mounting.

Headstocks for cylindrical broa sharpening are provided with reducti gearing affording spindle speed of 2 and 400 r. p. m. Tailstocks are equipp with quick-release spring-loaded center Barrel type steady rests have conta points made fr round fiber to pr vent injury broaches. Adju able stops, co spring cushion are provided the broach ha cross slide guard again shock at the e of the stroke the head wh sharpening fl broaches.

If desired, t Model CS2 can obtained with head and ta



Colonial Model C Broach Sharpen

stocks, steady rests, and so on, for sharpening flat broaches only. Magnetic chucks for grinding flat broaches are available as extra equipment.

Michigan "860" Series Rotary Crossed-Axis Gear Finishing Machines

Designated as the "860" Series, an improved line of rotary crossed-axis gear finishing machines is now in production at the Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. The line comprises four basic models—the 860 for shaving narrow face and shoulder gears by the "underpass" method; the 860-B for shaving wide face gears by the "transverse" method; the 860-A in which both the "underpass" and "transverse" shaving methods are provided; and the 860-C for shaving of internal gears. The first three models are available in three sizes for shaving gears with maximum O. D. of 8, 12, and 18 inches.

All 860 Series machines utilize Cone-Drive gearing which is said to ensure maintenance of initial operating clearance tolerances over long periods. In addition, with the greater rigidity provided in the machines, motor power has been increased to 2 h. p. to afford a reserve for special jobs. Improved facilites for curve shaving are available as optional equipment on the 860 machines.

Great ease of adjusting reciprocating speeds is afforded on all improved machines. On the 860, 860-B, and 860-C two sets of change gears are provided, one set affording five variations in cutter spindle speed while the other provides five variations in speed of the reciprocating mechanism. On the 860-A

M-D Facing Heads

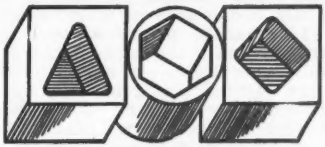
With Automatic Feed

Can be attached to Boring Mill Bar, and Drilling or Milling Machine spindles. Single point tool travels radially, from center outward or reverse, feeds automatically. Sizes 6" to 46" diameter.

Write for circular.

MUMMERT-DIXON CO.

120 PHILADELPHIA ST. HANOVER, PA.



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BY A QUICK, EASY, INEXPENSIVE METHOD

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WATTS BROS. TOOL WORKS
Wilmerding, Pa.

EVERY ONE A "CHAMPION"

CHAMPION

EXPANDING MANDRELS

Any size hole within a 1" range of infinite variation! That's what one size Champion Expanding Mandrel will completely and accurately handle. The hardened steel flexible sleeve automatically expands to the correct size as it is raised on the tapered arbor. Only 12 champions needed for range from ½" to 6½". Eliminates numerous solid mandrel sizes. More convenient. Costs ⅔ less. Proved for years by thousands of shops.

The WESTERN Tool and Manufacturing Co.
SPRINGFIELD, OHIO

SEALED PROTECTION FOR FINE TAPS

Reiff & Nestor Taps now delivered to you sealed in a Moisture Proof, Shock-Resistant, Tough, Plastic jacket that gives the cutting edges the perfect protection fine tools deserve.

No more chipping in transit or injury from Tool Room handling.

Reiff & Nestor Plastic jacket is easily removed and may be used again and again.

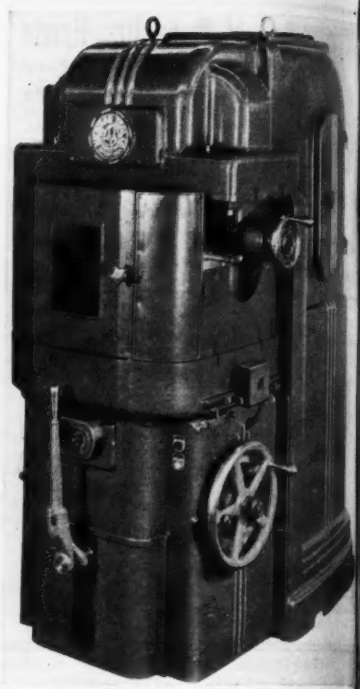
There is no extra charge for this Reiff & Nestor innovation.

The new Reiff & Nestor Catalogue and Tapping Guide — Just out. A request on your Letter Head brings it.

REIFF & NESTOR CO.
LYKENS, PENNA.

on which two optional methods of shaving gears (underpass or transverse) are offered, separate provisions are made for change gears for each of the movements. The design is such, however, that the same actual gears can be used interchangeably for the underpass or transverse change gears. Standard machine equipment includes six gears each for cutter spindle and reciprocation speed changes.

In line with mechanical improvements providing longer service life of the 860 Series machines, these models feature more efficient sealing to further reduce maintenance requirements. A "one shot" lubricating system is provided for oiling all moving parts. Control panels are enclosed for protection against dirt and dust, leaving only the simple cycle controls exposed for accessibility in machine change-overs. Cutter housings are also provided with improved seals to protect against entry



Michigan 860-A Rotary Crossed-Axis Gear Finishing Machine

of foreign matter. Vernier scales on the front of these housings simplify crossed axis settings.

DoAll "Zephyr" High Speed Sawing Machine

Especially designed to meet versatile sawing requirements, a high speed sawing machine to be known as the DoAll "Zephyr" is now being manufactured by Continental Machines, Inc., 1306 S. Washington Ave., Minneapolis 4, Minn.

DoAll "Zephyr" High Speed Sawing Machine

Rigidly constructed, the machine features a 36-inch throat depth and 18-inch work thickness capacity and is provided with speed range of from 150 to 10,000 feet per minute.

The speed range is infinitely controlled by a "Speedmaster" variable speed pulley. A "job selector" dial indicates the saw control factors for the shaping of 104 basic materials, including plastics, plywood, asbestos, rubber, metal sheet stock, nonferrous alloy castings, cast iron and alloy steels.

To protect the operator at the point of work, automotive hydraulic brakes are provided on the upper and lower

controls and the foot pedal controlling the hydraulic brakes are located within easy reach of the operator.

Standard equipment of the DoAll Zephyr includes a 10 h. p. variable speed drive and a 30 x 30-inch work table with a secondary table extension of 17 x 20 inches. The machine has a four-way table tilt—45 deg. to the right, 10 deg. to the left, front and rear—and an adjustable table lamp for illumination at the point of work. Pipe flange arrangements are provided for exhaust removal of chips.

The upper wheel of the machine ... spring tension mounted so that the sa... band is under proper tension at a... speeds. The special saw guides pro... vided are adjustable for saw band... from ¼ to 1½ inches wide. The ma... chine is supplied complete with ... assorted saw bands.

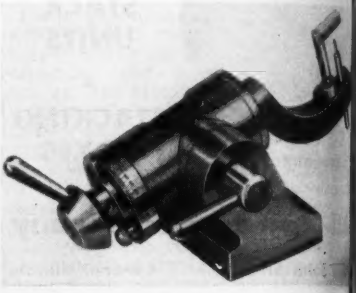
U. S. No. T-124 Angle Correcti... Radius Dresser

Designed not only to do the work of ... radius dresser but also to dress the co... rected radius on a wheel for grindi... compound and compound-complex a... gles on flat form tools, and so on, t... U. S. No. T-124 Angle Correcting Radi... Dresser shown herewith has been plac... on the market by the U. S. Tool & M... Co., 6906 Kingsley, Dearborn, Michiga... To eliminate guesswork in dressi... wheels, the unit employs the direct rea... ing principle.

To use, the diamond dresser a... mechanism is swung through specifi... number of degrees, as indicated ... graduated scale located at right ang...

to the dressing axis, and locked in position. The dresser is then placed on chuck exactly on the center line of the grinding wheel, which is subsequently dressed to the radius required. For compound-complex angle, the same procedure is followed with the addition of swinging the base of the dresser away from the parallel bar of the chuck using the upper righthand corner of the base of the dresser as the pivot point and directly reading the angle (from blueprint) as before.

Equipped with Timken tapered roller bearings, the U. S. No. T-124 Angle



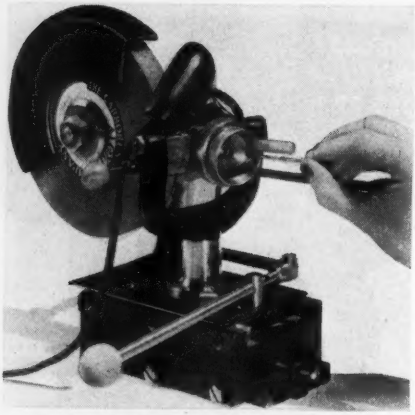
U. S. No. T-124 Angle Correcting Radius Dresser

Correcting Radius Dresser is light weight yet sturdy in construction to assure the production of smooth and precise radii. Both angle scales are easy to read and easily accessible. All exposed unpainted parts of the unit are chrome finished to guard against stain and rust. In addition, the dresser is constructed with a hardened tool steel wear plate on the underside of the base to prevent chipping and wearing of the cast iron body.

Tombill Drill Sharpener

An attachment for use in sharpening twist drills from No. 70 to 15/64 inch, to be known as the Tombill Drill Sharpener, is now being manufactured by Mercury Products Co., 423 Euclid Ave., Cleveland, Ohio. Designed for use with any standard 6-inch or smaller grinding wheel, the attachment includes an illuminated magnifier and alignment bar for positioning drill for sharpening.

To use, the alignment bar is pushed, drill inserted in chuck, and chuck tightened. Next, the operator looks through magnifying glass and lines up lip of drill on the alignment bar. Grinding



Tombill Drill Sharpener

bar is then slowly depressed to limit and released, one lip of the drill being finish ground. To grind the other lip, the chuck is revolved 180 deg. and the grinding bar again depressed slowly and released. Every size drill to be ground on the attachment requires a separate bushing, ten of which are supplied.

EutecRod 195

Zinc base die castings, normally difficult to repair, are said to be easily and effectively reclaimed through the use of the improved gas welding rod—EutecRod 195—now being marketed by Eutectic Welding Alloys Co., 40 Worth St., New York 13, New York.

According to the manufacturer, the improved rod has a lower melting point and lower bonding temperature than the original alloy, thus making it easier to apply without danger of damaging the parent metal. In addition, the rod is said to be easier to build up with, and have greater tensile strength.

Beg Your Pardon!

In the announcement of the DoAll Economy Gage Block Set, which was published on page 264 of the July issue of this magazine, the wrong illustration was used. The DoAll Economy Gage Block Set actually includes 37 gage blocks as shown in the illustration.

Included in the 37 blocks are two 0.050-inch wear blocks in addition to five standard series of gage blocks. The first series consists of nine blocks from 0.1001 to and including 0.1009 inch in increments of 0.0001 inch. The second series consists of nine blocks to and including 0.109 inch in increments of 0.001 inch. The third series consists of nine blocks from 0.110 to and including 0.190 in increments of 0.010 inch. The fourth series consists of five blocks from 0.100 to and including 0.500 inch in increments of 0.100 inch, and the fifth series consists of three blocks 1.0, 2.0 and 4.0 inches. With these several series any measurement from 0.050 to 11.7995 inches can be made in increments of 0.0001 inch.

DoAll Economy Gage Block Set